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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Twentieth Annual Meeting, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 13th, 1897.

The 20th annual meeting of the Western Gas Association will be held at Cincinnati, O., May 19th, 20th and 21st, 1897, and will be called to order by the President, Mr. W. H. Odiorne, at 10 A.M., Wednesday, May 19th.

The Grand Hotel has been selected as the headquarters for the members, and the sessions of the Association will be held in a suitable room contained therein. A rate of $3 per day, American plan, has been obtained; rooms with bath, extra. Those who desire cheaper rates can obtain them at the Palace Hotel, located on Vine and Sixth streets; rates, $2 to $2.50 per day; or at the Hotel Emery, European plan only, rooms, $1, $1.25 and $2 per day. It is advisable that all write and reserve their rooms in advance of the meeting.

The Executive Committee have arranged for the presentation of the following papers:

"Revivification of Oxide of Iron in Purifiers," by Mr. I. C. Baxter, Detroit, Mich.

"The Failure of the Commercial Attempts to Supply Fuel Gas in the United States," by Mr. F. H. Shelton, Chicago, Ills.

"Selling Gas," by Mr. I. C. Copley, Aurora, Ills.

"Leakage," by Mr. E. H. Jenkins, Covington, Ky.

"An Oil Tar Separator," by Mr. John R. Lynn, Detroit, Mich.

"Welsbach Street Lighting," by Mr. H. Wilkiemeyer, Evansville, Ind.

"Wrinkle Department," edited by Mr. Geo. Treadway Thompson, New York.

Mr. F. Egner, who is now in Europe investigating inclined retorts, or "slopers," will send a communication giving the results of his investigations.

The Central Passenger Association, Trunk Line, Southern Passenger Association, and the Chicago and Alton, from all points in Illinois, have granted rates of 1½ fare for the round trip, conditional on 100 certificates being presented to the Secretary for indorsement. The territory embraced by the above Associations includes all States east of the Mississippi river, except New England, and Wisconsin.

All persons attending the meeting will purchase a first-class ticket at starting point, paying full fare for same, obtaining from agent a certificate stating that the person whose signature appears on same has purchased at full tariff fare one first-class ticket to Cincinnati, which certificate, after it has been signed by the Secretary of the Association and a representative of the above Passenger Associations, will entitle the purchaser thereof to a one-third rate returning home.

All persons obtaining reduced rates must apply to agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but they may be obtained by request, if notification is made in time. Persons outside the territory embraced by Passenger Associations mentioned above should purchase a ticket to nearest point within said Association, and from there purchase a ticket to Cincinnati, obtaining a certificate which will entitle them to a one-third fare returning to place from which certificate was obtained.

All queries sent to the Secretary for the Question Box will be assigned to members for answers.

A cordial invitation is extended to members of other Associations to meet with us, and to participate in the discussions of papers presented.

The Secretary will be pleased to answer any communications pertaining to the meeting, and will mail blank applications to any who desire to become members of the Association.

JAMES W. DUNBAR, Secretary.

BRIEFLY TOLD.

THE THIRD ANNUAL MEETING OF THE TEXAS GAS AND ELECTRIC LIGHT ASSOCIATION.—Our special correspondent "M.," who was in personal attendance at the Third Annual Meeting of the Texas Gas and Electric Light Association, held in San Antonio, on Monday, Tuesday and Wednesday of last week, telegraphed a summary of what was done at the meeting. His lines show that the weather conditions were perfect, that the hospitality of the city and of the Association's direct hosts (the San Antonio Gas Company) was unbounded, that the technical

proceedings were up to a high standard, that the attendance was large and representative, and that the social features of the convention were enjoyable, many and diverse. The proceedings of the first day were opened in the Menger Hotel, Mayor Callaghan, of San Antonio, receiving the members and their guests by a rather informal speech, which put everybody in good humor, and further impressed all that San Antonio was theirs during the time that they should remain within its boundaries. The welcome on behalf of the San Antonio Gas Company was cordial and effective; in fact, the Company fully carried out the pledges made by its President, Mr. Kampmann, when some weeks ago he formally invited the Association to hold its meeting in San Antonio. President Miller and Secretary Starr directed the proceedings with tact and resourcefulness, and the members completed the harmony by strict attention to business, when business was the order. Following the addresses of welcome came the annual message of President Miller, who said what he had to say in speech that could not be misunderstood. The balance of the first day's proceedings, aside from purely routine matter, was taken up in this order: The paper by Mr. J. C. Lord, of Fort Worth, on "A Means of Largely Increasing the Summer Send-out of a Gas Works;" the paper by Mr. H. L. Monroe, of Dallas, on "The Commercial Efficiency of the Incandescent Electric Light," and the paper by Mr. W. E. Holmes, of Austin, Texas, on "Little Things." These papers, in which many original points were brought out, all led to good discussions. The morning of the second day was given over to an inspection of the city of San Antonio, special trolley cars having been provided. The afternoon business sessions were taken up by the reading and discussion of a paper by Mr. W. M. Brooke, the paper on "A Few of the Many Details of Management," by Mr. A. E. Judge, of Tyler, and a protracted argument over the contents of the Question Box. In the evening the Association enjoyed a royally good banquet, 55 partaking of the well-planned hospitality of their hosts. On the last day of the meeting, the main features of the technical proceedings were the papers by Mr. J. D. Oliger, of Cleburne, on "The Operating Expenses of Electric Light Plants," and on "The Storage Battery as an Adjunct to Small Electric Light Plants," by Mr. W. L. Hall, of Mexia. The exhibition of gas and electric appliances was well arranged and attracted many visitors from the "ordinary" population of San Antonio, in addition to, of course, all of the delegates to the convention proper. The membership rolls were increased by the addition thereto of 26 names, and Laredo was chosen as the next place of meeting. Our correspondent failed to send the names of the officers chosen for the ensuing year, nor did he say anything about the prospects for the proposed excursion to Monterey, Mexico. The meeting, although there was much of electricity in it from the gas man's point of view in this section of the country, was an excellent one, and in due time a complete report of the proceedings will appear in our columns.

"Fuel and Refractory Materials."—Such is the title of a work recently received by us, the author of which is Mr. A. Humboldt Sexton, F.I.C., F.C.S., of Glasgow, Scotland. Take it all in all, the author has accomplished much in little, for within its 352 pages (nine of which are devoted to an excellent index), divided into 15 chapters, and enriched by 104 clear-drawn illustrations, he has in our opinion easily and well succeeded in making truth of the following "intention," which he outlines in the first paragraph of his preface: "This little book is intended to meet a want which the author has felt for many years, namely, that of a manual dealing concisely yet comprehensively with the subject of fuel, and holding a place between such exhaustive treatises as those of Dr. Percy and Dr. Mills and Mr. Rowan, and such brief outlines of the subject as may be found in manuals of metallurgy." Chapter VII. should be particularly useful to gas men when in need of something to prompt them hurriedly over the determination of the value of gaseous fuel, even though in vein (as is the book as a whole) written rather for the metallurgist than for the gas engineer. It is a book that undoubtedly will not lie idle in the bookcase of the studious gas engineer, for all that. The price of the book, neatly bound in cloth, is $2.

Notes.—The proprietors of the York (Pa.) Gas Company have voted to increase the capital stock to $200,000, from $100,000. Many improvements will be made on the plant.——The consolidation at Kansas City, Mo., has been completed. The business offices of the Missouri Gas Company have been closed, and Mr. Sweatnam has been appointed Assistant Superintendent of the consolidated concern.——The franchise and all properties owned by the St. Joseph (Mo.) Light and Fuel Company will be sold at public auction on June 12, in St. Joseph, pursuant to proceedings instituted in foreclosure by the Illinois Trust and Savings Bank, as mortgage trustee.

[Translated from *Le Gaz*, by Mr. Herman Poole.]

New System for the Instantaneous Lighting and Extinguishing of Gas Jets at Any Distance.

The facility and quickness of lighting possessed by electric lamps are obvious advantages in favor of this method of illumination; but, thanks to electricity itself, gas is now able to enjoy the same advantages, and we can produce at any distance, and instantly, the lighting and extinguishing of any number whatever of gas jets for public illumination, as well as for special cases.

Several attempts have hitherto been made in this direction, and several arrangements of electric lighting have been tried without having been put into practical use on a large scale.

It is not so, however, with the system of lighting and extinguishing devised jointly by Mr. Egraz, Director of the Gas Works at Aix-les-Bains, Doctor Guyenot and Mr. Chateau, Constructing Electrical Engineer of Paris (Guyenot & Chateau's patent).

At the last Congress of the Société Technique de l'Industrie du Gaz, held at Clermond-Ferrand, June 17, 1896, Mr. Egraz, assisted by Dr. Guyenot, showed us a specimen of the arrangement of the apparatus, and it was worked by them. This was, however, but a laboratory demonstration, so to speak; the practical adoption remained to be accomplished.

Since then the invention has progressed. Several interior installations have been put in service, with a success which is very flattering; and, finally, for the last three months an entire section of the city of Aix-les-Bains has been provided with this new method of automatic lighting and extinguishing for the public lamps.

A local session of directors of gas works, which convened at Aix-les-Bains on the 6th of last November, declared with what facility public lamps could be lighted or extinguished, partially or totally, by the installation of this new system of instantaneous lighting of gas jets.

This invention, which gives to gas works the means of lighting or extinguishing at will the whole or only a portion of the lamps used for public illumination in a city, gives the same advantage to special establishments which possess a more or less large supply of gas jets, which should be instantly lighted or extinguished, even totally or partially, according to the conveniences or demands of the establishment.

Summing up, this new method of lighting and extinguishing gas jets of all kinds by electricity permits:

1. *In Public Installations.*—To light and extinguish simultaneously all the gas jets in a given section, or a part only of the jets at a certain time and the other part at a later time. For example, all the gas jets could be lighted at 6 o'clock in the evening, a certain number of them being extinguished at midnight and the others at 6 o'clock in the morning. We may likewise provide for the lighting in two portions by a single wire.

2. *In Interior Installations, Cafés, Stores, Private Houses, Hotels, etc.*—To control at a distance the lighting and extinguishing of any number of jets whatever, either together or separately.

3. *For all Public or Special Installations generally.*—It allows the abandoning of the pilot lights in all lamps fitted with this arrangement, often defective, and whose consumption in many cases demands consideration, and the employment of Welsbach burners by guaranteeing the maximum service to the mantles; to remedy the troubles due to stopcocks and their use—stopcocks, especially after long use, are subject to loss of a portion of the gas, sometimes very appreciable, even when we think they are perfectly shut; to have *instantly in service* in places of assembly, such as theaters, casinos, etc., usually lighted by electricity, an additional source of illumination, in cases of accidents happening to the central depots or on the line of distribution; to close the meters at a distance in cases of fire, or at any time of the day when artificial illumination is not needed.

All the jets of a section, each provided with such an electric apparatus as we shall shortly describe, are connected with a line emanating from a source of electric energy, piles, accumulators or dynamo, and provided with special rheostat commutators.

Even when connected in line the burners are independent of each other, and an injury to one burner, even to the destruction of its lighter, does not prevent the others from working, unless the line is completely broken. The resistance of the apparatus being insignificant, low tension currents are employed, even for installations having a large number of burners.

One of the important or characteristic elements of this invention consists of a distributor-obturator having a practically perfect cut-off, put in play by the electric current and having communication possible only

with the burner. The actual stopcock is done away with. It is replaced by a special piece of inoxidizable steel, resting by its weight on an appropriate seat in such a way as to close the gas orifice, after the principle applied in hydrostatics to the ball valve pump. With gas the closing is as perfect as with liquids.

The movement of this steel piece, which moves up and down to open or close the gas opening, is obtained by means of a little piece of steel which is sometimes magnetic and sometimes neutral. To produce at will the magnetization and demagnetization of it they utilize in a particular way the current produced, whether by piles analogous to the Leclanché type commonly used for electric bells, or by accumulators, or by a dynamo.

The current is caused to pass for one or two seconds through a little spool acting on the piece of steel. When this piece is magnetized the gas is turned on; when it returns to its neutral state the gas is turned off.

At the moment the current passes, it acts on a small arrangement placed in derivation on the spool near the exterior opening of the gas and, according to the style of burner, the lighting is produced either by a spark or by the incandescence of a thread of special practically infusible composition. The pieces composing all the apparatus are very few and very simple, and the whole mechanism is not subject to derangement.

For an installation intended for the public illumination of a city, all the burners are connected by an overhead or underground wire; for interior installations the burners are connected with each other by wire like that used with electric bells.

To light a city the control is effected by means of a table, placed either at the gas works or at a central station, controlling several sections. In installations for interiors, the lighting or extinguishing is effected by means of buttons, analogous to those of electric bells.

To obtain by means of a single conducting wire partial lighting and extinguishing, with public installations, there is added to a certain number of ordinary apparatus a permanent magnet, placed in a position such that it always influences the steel obturator and transforms thus the apparatus into a polarized apparatus, opening and closing with the current in the spool, and without the piece of steel being demagnetized.

When the ordinary apparatus on the contrary has been once opened and lighted by any kind of a current, the piece of steel must be demagnetized to produce extinguishment. This demagnetization is secured by passing through the spool special alternating currents of very low force and of decreasing intensity, produced by the continuous current, transformed by means of a special rheostat commutator.

Let us consider now a system of lighting composed of two styles of apparatus, which may be arranged in any order desired. Suppose that the lighting must be carried out partially at two stages. In this case the winding of the spools must be such that they remain inert when a current of a given kind will light the ordinary burners which will become active the first.

At 6 o'clock in the evening, for example, a current of the kind and intensity previously determined is passed for several seconds and the ordinary burners are lighted. At 7 o'clock for an instant is passed a current of the opposite kind. The ordinary burner remains lighted, but the polarized burners, which were inert to the first current, now light in their turn.

At midnight there is turned into the line a current of opposite kind to the preceding, and consequently, of the same kind as the one used at 6 o'clock—the polarized burners, the last ones lighted, are then extinguished.

At 6 o'clock in the morning the line receives a very weak alternating, decreasing current by means of the rheostat commutator, and the ordinary burners are extinguished.

To have a single lighting and two extinguishings all needed is, that a lighting current be sent over the line of such a polarity that it influences at the same time the ordinary and the polarized burners. The polarity of the current has no influence on the working of the ordinary apparatus.

The rheostat commutator is composed simply of a hand reel carrying two ribbons communicating with the two extremities of the line. These ribbons are put successively in contact with a plate by fixed posts. Turning the reel by the hand the ribbons touch the post successively, sending along the line alternating currents, and with a decreasing intensity.

Several arrangements may be adopted to obtain this result, but the detail thereof would be too lengthy to be given here. If accumulators are used, by a proper arrangement of the elements, only a single resistance need be used in the whole line.

If a dynamo is used the resistances must be grouped in two distinct rheostats. Then it is easy to establish permanent communication between the rheostats and the points of the commutator, giving, by working the commutator, the desired currents. Whatever theoretically may be the working of the commutator, it is well to handle it with a certain slowness, to render the transformed currents perfectly harmless.

The public lighting of a section of Aix-les-Bains is only one of the numerous applications of the new invention, which is destined to render as much service in special positions as in city lighting.

Any existing apparatus may be changed to this system without injuring its elegance in the least. With this new system of lighting and extinguishing we shall have no more stopcocks, no more leaks possible by these stopcocks, so often in bad condition; no more inconvenient lighters; no more burners with pilot lights; no more Welsbach mantles broken by careless lighting. A push-button in any convenient place is all that is necessary; push it, and instantly all burners in the system, all heating apparatus, all cook stoves are lighted immediately.

The absolute solidity of the apparatus gives perfect assurance of the complete shutting off of the meters, which may be worked automatically by the same method.

Any number of burners whatever may be lighted or extinguished by means of a single button. We have, therefore, at our disposition all the combinations employed in electric lighting, to which are added the advantages of the convenience and economy which go with gas, which usually are to be had at the higher price of electricity.

The Detection of Leaks in Gas Mains.

The *Journal of Gas Lighting* remarks that the question of leakage, or "unaccounted for gas," is one which is acknowledged to be of growing importance. Owing to the greatly extended use of gas, the network of mains is continually being increased both in length and diameter; while the soil beneath the public streets is traversed in every direction by sewers, water pipes and different kinds of electric cables. Moreover, on account of the more general employment of gas for cooking, heating and motive power purposes, it has to be sent from the works at higher pressure, which has to be maintained throughout the day. Again, consumers demand reductions in price, so that as the annual amount of unaccounted-for gas tends to increase, the financial importance of the question is more keenly felt. Hence a simple, efficient and economical plan which enables the relative extent of the leakage in each district to be rapidly determined at all seasons of the year will be of great value to gas companies and municipal authorities. It is proposed in the present article to describe a plan which, it is claimed, possesses all the above named qualities, and to give a brief account of some of the results obtained by it.

To reduce the quantity of gas lost by leakage is to increase the productive capacity of the works, and to effect at the same time an annual saving. This will be of advantage to the supplying company in one or two ways: (1) If the cost of manufacture is reduced, the working capital is lowered in proportion. The weight of coal to be handled and screened, and of coke to be disposed of, will therefore also be decreased. The value of the gas saved, as a rule, repays in one year the first cost of the plant used for detecting the leaks. (2) The recovered gas is rendered available for sale. The economy realized in this case is on the mean selling price, for the quantity sold to the consumers is augmented by what is saved; and the sum thus received is clear profit. Supposing the total sale increases in two or three years by 5 per cent. In the case where the sale was originally 100, the cost of production being 50 per cent. of the receipts, the former becomes 105, and the clear profit 55 per cent.—an increase of 10 per cent. A further advantage resulting from a prompt and easy detection of the leakage of gas is the freedom from the risk of accidents, explosions or fires due thereto. Fortunately these are comparatively rare in England; but when they do occur they are extremely costly. The first object of a leak detecting system, however, is to prevent waste of gas; and we give two cases where considerable saving has been effected as the result of the employment of the system which we wish to bring under the notice of our readers—viz., that of M. Bouvier, of Lyons, which was fully described and illustrated in the *Journal* for Oct. 17, 1893 (p. 725). The figures were obtained from the managers of the respective works.

In the first case, the installation of about forty of M. Bouvier's siphon isolators at a cost of $600, with an additional $1,080 for repairs to mains, resulted in an increase in the quantity of gas sold simultaneously with a diminution in the production; and the saving went on continuously after their installation. This is one of the strong points of the system.

The first inspection reduced the leakage by 1,836,400 cubic feet, or one third; while the quantity of gas sold increased by 565,200 cubic feet though 196 tons less coal were carbonized than in the previous year. The second inspection, at the end of the succeeding year, enabled a further saving of 854,800 cubic feet to be made, of which 462,400 cubic feet went towards augmenting the bulk of gas sold. The gas accounted for increased by 2,120 cubic feet per ton, and the leakage per mile per year was reduced by 273,300 cubic feet. By a third inspection, in the following year, a further 384,800 cubic feet were saved—the leakage being finally brought down to 1,839,700 cubic feet, or a little more than one third of the former amount (4,977,700 cubic feet). Then 229,500 cubic feet more were sold, and 155,300 cubic feet less produced; and the loss per mile of main per annum was brought down to 173,900 cubic feet. This caused an increase of profits, arising from two sources: An increased sale of gas to the extent of 229,500 cubic feet; and the saving resulting from having to produce 155,300 cubic feet less gas. Plainly, in this case, the increased returns are clear profit. The total gain in the three years amounted to 3,138,000 cubic feet a year on the former state of things. The result is that, supposing the quantity of gas sold to remain constant, there will be an annual economy to the above-named extent, which, with gas at 54 cents per 1,000 cubic feet, means a saving of about $1,695 per annum for a definite expenditure of $600 on plant, or a total outlay of (say) about $1,680, including the needful repair of defective mains. The receipts arising from the greater consumption of gas due to a larger number of burners being in use constitute a net saving; and 3,138,000 cubic feet more gas than formerly are available to meet the increase. In other words, until the consumption has augmented to the extent of 3,138,000 cubic feet, the dividends may be increased by the amount equal to the savings realized by stopping the leaks, without any further extension of the works.

We now turn to the second case, which refers to other works, the figures for which, in tons and cubic feet, are—

	Coal.	Gas Produced.	Gas Sold.	Gas Lost.
First year.....	9,442	101,330,000	80,880,000	17,490,000
Second year...	9,084	93,660,000	78,460,000	12,455,000
Decrease..	358	7,670,000	2,420,000	5,035,000

The decrease in the quantity of gas sold during the year is mainly due to the adoption of the Welsbach burner; but it has been more than compensated for by the economy realized. After the first inspection, the saving was 174,400 cubic feet per mile. A further saving of 1,060,000 cubic feet was effected during the first half of the third year.

In order to discover gas leaks methodically, their extent must be measured in each actual section of the mains. Consequently, an appliance for each section has to be employed. The measuring apparatus should be quite independent of the rest of the distributing plant. Therefore, in place of a meter, the use of which may be theoretically correct, but is impracticable in every-day work, there is substituted in M. Bouvier's system a portable gasholder, which is stronger and more accurate than a meter, and enables the mains to be tested under increased pressure from that already existing in them. The gasholder fills itself automatically with gas from the supply end of the isolated section; then, being loaded with weights, it forces this gas into the section under test at a regular pressure. The gasholder shows both the volume of the gas and the increase of pressure necessary for an exact and rapid test—advantages which a meter by itself does not possess. Measuring leaks by means of a gasholder is quicker, more accurate and more sensitive than by any other method. Independent of the general distribution of gas, it gives at once a very clear idea of the state of each section, and shows by figures, from accurate observations recorded in a note book day by day and street by street, the relative importance of the leaks therein.

As already mentioned, M. Bouvier's appliance has been described in our columns; but it may be useful to give again a few particulars in regard to it. The 1894 type of isolator is U-shaped, the two arms at the upper end branching off horizontally in opposite directions, and being connected directly to the mains with tulip or indiarubber ring joints. A cast iron rib or partition between the two branches of the siphon serves to unite three small vertical tubes used for taking gas from the right and left side, and for pumping the water from the center of the apparatus. The lower chamber, which is provided with an outlet at the bottom to facilitate casting, is made absolutely steam-tight. All corners are rounded off to prevent loss of pressure in the flow of gas; and finally the section is increased to compensate for changes in direction. The siphon, which is entirely of cast iron with the exception of the joint on the top, is fitted with iron tubes for the introduction of gas and water; and the cover plate is bolted to the top flange. The body of the inspection chamber is circular, with a square top 11 inches by 11 inches. The isolator is self-contained, and, being without any mechanical complications, does not entail any outlay for maintenance. Its first cost is small, and it is easily fitted in the mains, with which it then forms part. The seal is formed by water being poured down the central tube. The gasholder is supported by two gudgeons on a light angle iron frame, with iron wheels and carriage springs. The receiver is annular, to diminish the weight. The inside cylinder carries, besides the two inlet and outlet gas tubes (closed at the outer end by a rubber seated valve), a blow-off cock. The gasholder is fitted with a scale graduated in cubic feet, a pressure gauge and counterweights. The bell, which is about 3 feet high, is capable of holding 10½ cubic feet—a quantity sufficient to raise the pressure from 1 to 4 inches of water when connected to mains of a capacity of not less than 1,450 cubic feet—*i. e.*, the capacity of a main 12 inches in diameter and 2,000 feet long. In case the section under test exceeds this length, all that is necessary is to fill the bell more than once. The leakage is measured in cubic feet per minute under a 4-inch pressure by the rate of descent of the bell. The apparatus is strong, handy and very light; the tank holding only 4½ cubic feet of water, which is poured in just before making a test.

The most suitable time in the day for testing is between 4 and 6 o'clock in the morning; and the method of testing is as follows: The cocks of the branches in the section to be tested must first be closed. The section under test is then isolated by filling up the siphons which connect it with the rest of the system. The gasholder is brought close to the spot, and the annular space surrounding the falling bell is filled up with water, the siphon inspection chamber opened, and the two outside tubes connected by rubber pipes to the two cocks on the gasholder. This is then put in connection with the "up-stream" side of the siphon, and the bell ascends—filling itself with gas. When it has reached the top of its run, the inlet valve is shut off, and the bell full of gas is loaded with weights. The cock on the "down-stream" side is then opened, and the bell begins to settle down—descending rapidly at first, and stopping when all the gas in the isolated section of the main is raised to a pressure of 4 inches. The bell then commences to descend farther, at a regular pace. Its velocity at this stage must be carefully noted, as it is these readings which measure the actual escapes. The results of the gasholder tests are entered in a special note book kept for the purpose; the leaks in each district or section being located during the day by means of palladium tests, and repaired as soon as possible. Finally, another general test made with a portable gasholder one or two months afterwards shows exactly what saving has been effected in each district, and how the reduction of leakage is to be continued in the future. Thus a gas manager can in a few months, it is claimed for the arrangement, bring the leakage to a practically negligible quantity.

The other method of detecting leaks in gas mains—viz., by means of the palladium test—is so well known that it is unnecessary to describe it, but certain precautions must be taken with its use, the test paper being sensitive to sulphureted hydrogen, which may be given off from the soil, as well as to the carbonic oxide present in tobacco smoke. Sunlight also exerts an influence upon the slips. Palladium tests should be conducted with extreme care; and only under these conditions are the indications at all reliable. However, when considered by themselves, these tests are wanting in accuracy, and therefore they cannot be relied upon as complete. The accuracy necessary to improve a network of mains, however, is insured by measuring the leaks, district after district, under pressure, by means of the siphon isolator and the portable gasholder. The palladium test, though of little value by itself, forms a valuable check on the records when both systems are employed.

Summing up what has been stated above, we have only to say that it is claimed for M. Bouvier's system of detecting leakage that it is simple and easily carried out, that the first cost of the appliance is small, and that the expenses of maintenance are practically *nil*. As shown in the two examples given, the saving is at once apparent and considerable. These results are only two out of a number of similar cases, but they suffice, we think, to demonstrate conclusively the great reduction in leakage which it is possible to effect by the use of the system here described, and the consequent pecuniary advantage that ensues from its employment.

Engineering Compensation.

At the tenth annual meeting of the Montana Society of Civil Engineers, Mr. M. S. Parker, M. Am. Soc. C.E., delivered the following address:

How seldom does the old and experienced civil engineer advise the young man about to begin his career in life to adopt the profession of civil engineering! To his brother engineers the reason is obvious. The practice of the profession does not offer pecuniary inducements

commensurate with the study, hard work and experience necessary to possess the title C.E. in its fullest meaning.

The preliminary education necessary for the civil engineer is not less than that required for any other professional calling, and the subsequent training is as exacting in its requirements.

The civil engineer, ripe in experience, has passed through an ordeal of preparation that should entitle him to the highest consideration among the professions and a proper remuneration for his services. Alas, how seldom is this the reward for valuable service rendered! The maximum compensation for engineering services is at best meager when compared with the compensation for other professional service. The railways of the world have given employment to a large majority of the civil engineers during the past fifty years. There is probably no class of professional men who have rendered more valuable service to the world at large than the civil engineers employed in building the railways, and probably no class of men have received less compensation for services rendered. The same amount of time, energy and hard work expended in any other direction would bring to this class of men their well earned reward.

How contrary is the experience of those employed in this great work of civilization! The compensation for such services is barely sufficient, with proper economy, to support a man with a family from month to month. Should disability or loss of position occur, there is no bank account possible to tide over any considerable loss of time. The engineer engaged in this line of employment loses touch with other branches of his profession. His main reliance is on railway work. This means unsteady employment. The result is well known to engineers.

The plums are very scattering in the pudding. Permanent positions are few as compared with the transient positions. The ever-to-be-feared order for reduction of expenses is a constant menace to the quasi-permanently employed engineer, and makes his tenure of office very uncertain.

The architect, the near relative of the engineer, receives his compensation according to the magnitude of his work. The larger the sum of money to be expended under his direction, the larger the amount of his commission for services.

The lawyer receives fees according to the magnitude of importance of his case, and leads all professions in the matter of compensation for services rendered. The physician is rewarded for professional services according to his ability and experience. The physician having climbed the ladder of successful practice has no limit to his charges except his tender conscience. Running through the list of professions open to the young man, we find, for pecuniary success, the profession of civil engineering offering the least inducement of them all. For immediate results, possibly the engineering profession is the leading one. The young graduate engineer secures almost immediately in times of prosperity a position that might be the envy of his fellow-student in some other profession, both for its responsibility and the accompanying pecuniary reward, but here such envy should cease.

Let us look ahead ten years. Should the young engineer have cast his lot among railway builders, he has acquired ten years of valuable experience in this line of work—knowledge that cannot be obtained except by such experience. His services have become more valuable to his employer, but his salary has not increased with his usefulness. The difference in compensation between the first position secured and the position after ten years is not material, and we may add another ten years, and the difference is less proportionate.

One instance will illustrate this. A company proposes to build a railway. An engineer is selected to locate the road. This selection is made with regard to the ability and experience of the engineer. The expenditure of millions of dollars is placed under his direction, relying on his ability and judgment to make the best selection as to location and the most economical expenditure of the money. This large expenditure is left almost entirely to his judgment, the projectors of such enterprises, as a rule, having little knowledge about such matters. His immediate superior is a chief engineer, whose duties are more of an executive and advisory nature. It may be said that the engineer in the field is the sole responsible person for the economic location and construction of a railroad. This engineer, having the expenditure of millions of dollars under his direction, has a great responsibility resting upon him, as all must admit. Mistakes in judgment can cost his employers large sums of money. The engineer who by education, experience and ability is fitted to take this responsibility upon himself, receives the munificent monthly compensation of possibly $200, seldom much more, and often less. This compensation is for transient monthly service, his tenure of employment expiring with the completion of the work. In what other line of professional employment can be found a greater responsibility with so little pecuniary compensation? Americans are led to believe that they are the best paid people in the world, and in most instances this is true. As applied to civil engineers, however, the statement is incorrect. In England the compensation for engineering services is far above the standard of the United States, and ranks the profession nearer on an equality with the other recognized professions. Wherein lies this poor appreciation of the services of the civil engineer in this country?

The author is led to believe that it lies wholly with the members of the profession themselves. The tendency has been to depreciate the pecuniary value of their services. The present system of competitive bids for engineering service is one of the depreciatory measures in existence, and is very detrimental to the prosperity of the engineering profession, very demoralizing in its effects upon legitimate compensation. Such methods of obtaining professional service should be completely ignored by engineers as being unprofessional and beneath their dignity. An individual or corporation does not ask for bids for legal services. The individual in need of a surgical operation does not ask bids from surgeons to perform the operation, neither does the head of a family ask for bids for medical attendance of his family for a period of time. How many reputable attorneys or physicians would so lower their professional standing as to enter into any such competition? Yet this is a growing practice in this country in acquiring engineering service. It is not difficult to comprehend where the encouragement of this practice will lead the engineering profession.

One instance that the author has in mind of the many that have come to his attention will serve to illustrate this practice. A Southern city desired to make extensive municipal improvements, establish a sewerage system and grades of streets and pavements, the entire improvement involving the expenditure of about $400,000. The city fathers had appropriated $15,000 for engineering expenses, including superintendence—a reasonable amount for the services expected. They then asked for bids for plans, specifications and superintendence of the work projected. The Board of Public Works desired to engage a certain engineer of long experience and high standing to do the work, but under the resolution of the City Councils, bids must be submitted for the required service. The engineer who was the choice of the board submitted a proposition, but not in the nature of a competitive bid—merely a reasonable figure for his services. What was the surprise of members of the board and of the engineer selected, on opening the bids to find offers from engineers who are recognized as authority upon such matters proposing to do the work for about one-half of 1 per cent. of the proposed expenditure, and about one-third of the sum proposed by the engineer chosen by the board. The bid accepted for the entire work was $2,200. This bid was from a prominent and well known civil engineer of New York. There was such a gulf of difference between the lowest bid and the proposition of the engineer selected that, in the face of public opinion, the contract had to be awarded to the lowest bidder—a very erroneous practice in vogue among municipal corporations, as the sequel often proves.

Such methods of practice cannot be too severely condemned by the civil engineering profession. They lead to careless and inefficient work, and thus bring discredit upon the profession. What standing can be expected by the profession at large when its leading members so lower their professional dignity? Does it not place the profession on a par with a commercial body? There should be a code of professional ethics among civil engineers that would not tolerate such practice. Such practice should be stamped out in its infancy. To encourage it means the degeneration of the profession in the future. If executive ability, combined with knowledge of the science of civil engineering, is not to be appreciated in the engineer, why devote his life to it, when other avenues of life are open to him in which he may find honor and proper compensation for the faithful performance of his duties? There comes a time in the lives of all men when work is impossible. It is the duty of every man to provide against such a time. Should the civil engineer be obliged to work his life through for the bare privilege of living from day to day, knowing that when health or strength fails him he is to become an object of charity? How many engineers recognize this fact as they advance in years, and seek to better their future financial condition by engaging in other more remunerative occupations? This is not done from choice, as the civil engineer loves his profession, but as a matter of necessity to provide against future want. This is a sad commentary upon the profession in this country; still, it is true. The poverty of engineers is proverbial. Is it strange that the old engineer advises the young man to avoid the profession and cast his lot in some other vocation? The profession of civil engineering is as old as history. It is one of the most honorable and noble callings. Its members have rendered invaluable service to mankind, and stand upon the roll of honor of the world's greatest benefactors, and it is greatly to be regretted that so noble a vocation should be so poorly rewarded in this world's goods.

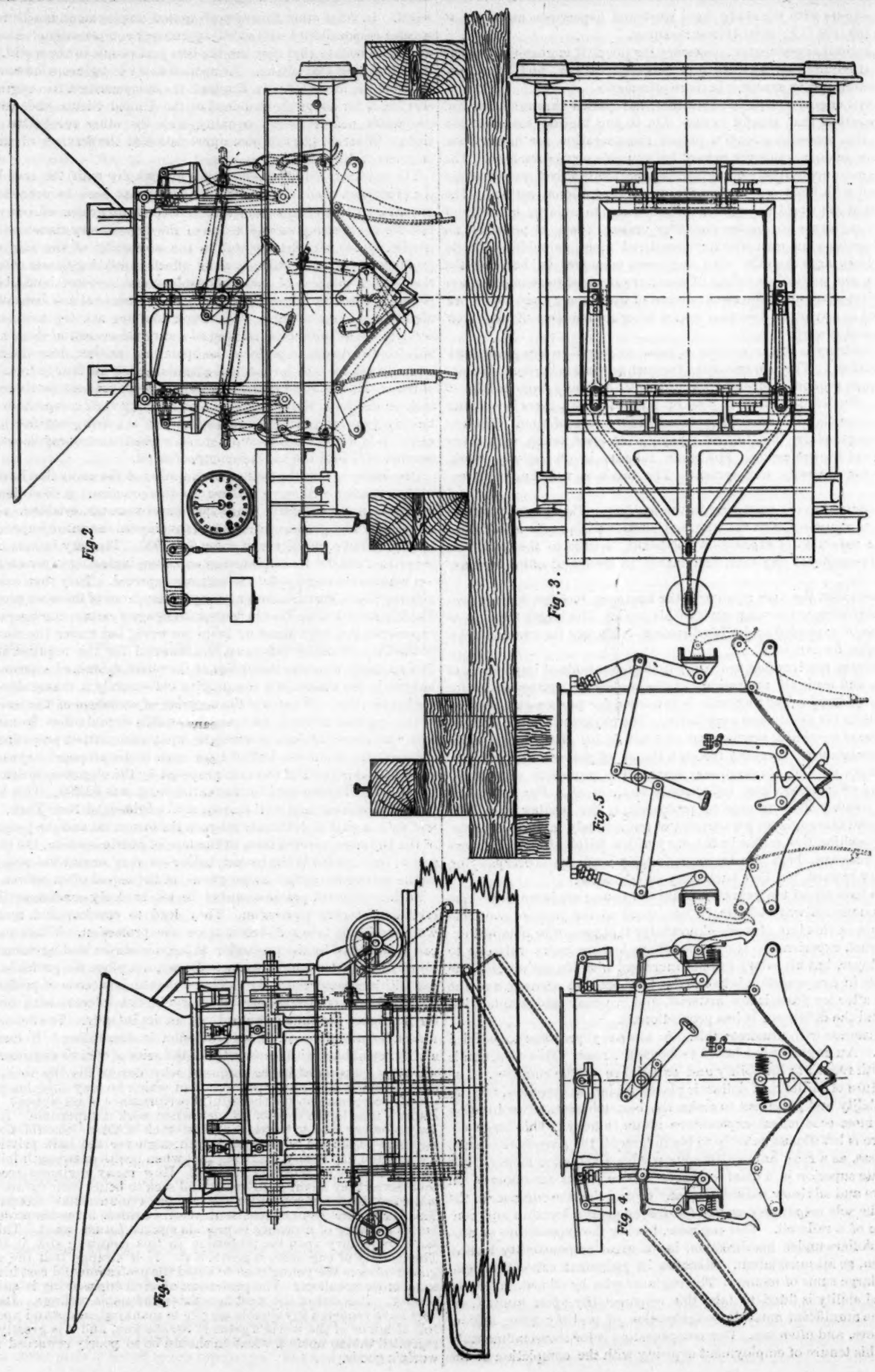


Fig. 2.
Fig. 3.
Fig. 5.
Fig. 4.
Fig. 1.

The Ingrey Coal Weighing and Recording Machine.

Engineering says that the accurate weighing and recording the weight of coal without the intervention of an attendant or "meter man" appears to have been accomplished by the machine designed by Mr. Charles Ingrey, of Bishopsgate House, Bishopsgate street, London, E.C., for Messrs. W. Cory & Son, for use at their Victoria Docks coal derricks, and illustrated on pages 642 and 643. At this station the steam vessels are moored at one side of a timber staging, and the coal is delivered by hydraulic cranes and 1-ton "skips" to barges on the other side.

The present arrangement adopted for weighing the coal consists essentially in mounting the chain pulley upon the end of a lever which is pivoted to the crane jib. The skip, when loaded, is raised by the crane, and brought to a state of rest, and the weight is indicated by the position of the opposite end of the lever, allowance being made for the weight of the skip and a portion of the lifting chain. A "meter man" is employed to take the record, and after he has done so, the crane is again set into motion, and the skip is lowered and emptied into the barge. The delay caused by the resting of the load, the necessity for employing a "meter man" for each crane, and the uncertainty of the results obtained, are serious objections which Mr. Ingrey's machine has been designed to overcome. According to his arrangement, which we show in our illustrations, no "meter man" is necessary, and no period of rest is required during the operation of the crane, and consequently a greatly accelerated speed of delivery is attained. The skip is emptied into a hopper, Figs. 1 to 3, at the top of the machine, and while the crane is swinging back with the empty skip, the operation of weighing, recording and delivering is effected, and the machine is restored to its normal condition ready for the succeeding load. It will be seen from the illustration that the machine is portable, and is mounted upon wheels which are made to suit the 10 ft. gauge of the crane in connection with which the machine is to work. Beneath the hopper is a bucket having at its bottom a pair of doors capable of opening outwards, and retained in their closed position by compound hooks, as shown in Figs. 2, 4 and 5, the doors being provided with over balance weights, so that they will always return to their closed position. The upper part of the bucket is provided with knife-edged trunnions which engage with steel centers on the end of a weigh beam (Fig. 2); the beam itself is swung in knife-edge links, and at the other end is provided with a weight which correctly balances the beam and the bucket. Upon each of two sides of the upper end of the bucket are two lugs or flanges having holes into which engage the conical or spherical ends of the toggle frames (Fig. 4). When the machine is in its normal position the toggles are in a vertical attitude, and support the bucket in a rigid manner, lifting it clear of the knife edges, so that the blow due to the falling mass of coal is received by the toggles, which act as columns and prevent any vibration being transmitted to the recorder.

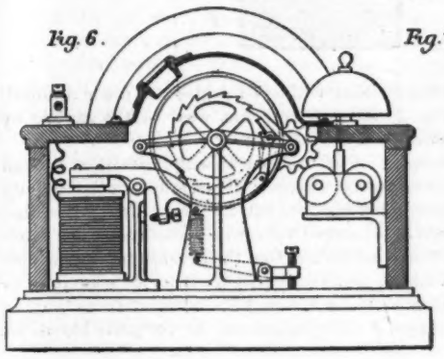


Fig. 6.

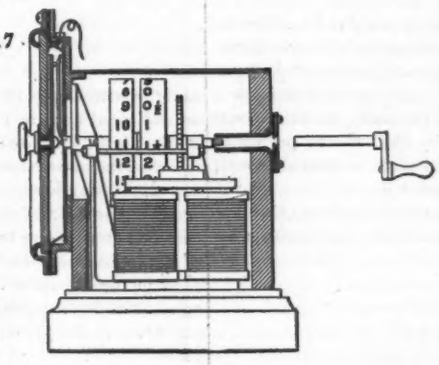


Fig. 7.

When the coal has been received into the bucket, the toggle frames are moved by the action of the outward movement of the crane, so that the bucket is lowered on to the knife edges of the beam (Fig. 5), and the weight transmitted to the recording apparatus, which is operated by a rod connected near to the opposite end of the beam. The action of returning the toggles to their normal vertical position causes the retaining hooks of the doors to be raised, so that the doors open by the weight of the coal within, and the load is delivered to a shoot to the barge beneath (Fig. 1). The doors are retained in their open position by means of hooks or catches which are disengaged by the final movement of the toggles, whereupon the doors relock themselves for the next operation.

In the case in question the cranes are worked by hydraulic power, and the necessary movement of the toggle frames is imparted by the water pressure operating in a small double-acting cylinder, which works in connection with a valve so arranged with regard to the crane post, that by means of a tappet, or cam-path, the pressure is transmitted or released from the cylinder at a time when the crane jib is swinging away from the machine. When a steam or any other kind of crane is employed, the necessary movement to the toggles can be imparted by a rod or chain working in connection with the crane post or swinging gear. The amount of motion to the toggles being very slight, the amount of power to operate them is trifling. It will be seen that the withdrawal of the supports from the buckets enables the coal to practically weigh itself.

The small outline views (Figs. 4 and 5) show the two positions of the toggle frame, that on the left giving the vertical position, the bucket being supported; that on the right showing the toggles withdrawn, the bucket being then free to descend with its load. The opening of the doors is effected by a prolongation of the lever which works the toggle; this comes in contact with a pawl at the end of an extension of one of the door hooks.

The recording apparatus is made in some respects after the manner of a spring balance weighing machine, but is provided with a train of wheels which operates five discs, each marked with 10 main divisions, and each division being subdivided by 10, respresenting respectively decimal, units, tens, hundreds and thousands of tons, the total capacity being consequently 9,999.9 tons (Fig. 1). An adjusting arrangement is provided, so that the balance of the machine can be regulated, and as the load is gently lowered by the toggles onto the knife edges, sudden jerks and vibrations are avoided, and the recorded weigh is accurate.

We are informed that it is proposed to make machines on this principle for a variety of purposes and of several sizes, and from our inspection of the working model at 55 Bishopgate Street Within, E.C., we certainly think there is a wide application for the invention.

In connection with this weighing machine, Mr. Ingrey has devised what he terms a barge loading apparatus, which will be understood on reference to Figs. 6 and 7. This is an instrument working by electricity, and arranged to operate by means of electrical contacts with the decimal wheel of the recorder. The dial is marked up to 200 tons, which is the limit of the capacity of a coal barge. Two counterwheels are operated by means of a ratchet working in conjunction with an electro-magnet, the figures on the periphery of the counterwheels representing respectively half tons, tons, tens and hundreds of tons. The dial is provided with two fingers or hands, one red, the other black. The red hand is set with the number of tons required to be delivered into a barge. The black hand travels as the counter works, and when it reaches the position indicated by the red hand electrical contact is made, and a bell is set ringing to warn the attendant or the man in charge of the crane that the desired amount of coal has been loaded into the barge. The instrument is restored to zero by means of a key inserted through a tube at the back.

Protective Bushing and Holder for Rubber Gas Bags.

On April 13th U.S. Letters Patent (No. 580,689) were issued to Messrs. John Hearne and Elmer E. Cisco, of Brooklyn, N.Y., for an improved protective bushing and holder for rubber gas bags, which invention is supplemental of the device described by Mr. Hearne in the JOURNAL for March 23d, 1896. Using the words of the specification:

This invention relates to certain improvements in protective bushings and holders for flexible gas bags, such as are employed for plugging gas mains temporarily during repairs; and the object of the invention is to provide a device of this character of a simple and inexpensive nature which shall be adapted to hold a gas bag in place when inflated in the main; and also to protect said bag against being torn and damaged by contact with the rough and sharp edges of the opening in the main whereat it is inserted or withdrawn.

The invention consists in a bushing adapted to be inserted in the opening in the main and a cap for attachment to the bushing to close the same and provided with means to hold the neck of the gas bag.

The invention also contemplates certain novel features of the con-

struction, combination and arrangements of the various parts of the improved device whereby certain important advantages are attained, as will be hereinafter fully set forth.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a sectional view taken longitudinally through a gas main, showing a gas bag held in place in the main by means of our improved protective bushing and holder. Fig. 2 is an enlarged fragmentary transverse section showing the device in place in the main, the opening in the cap wherein the neck of the gas bag is received being closed. Fig. 3 is a plan view of the device constructed in accordance with our invention, the aperture in the cap wherein the neck of the gas bag is held being shown partly opened; and Fig. 4 is a side view of the device shown in Fig. 3.

In the views, 1 indicates the main, and 2 indicates the bushing inserted in the opening therein, the bushing being provided with a central opening 3, extending through it and having its lower portion reduced slightly and provided with an exterior screw thread 4, adapted to screw into the walls of the opening in the main 1. The device will be usually placed in position after the opening in the main has been formed and tapped. The upper portion of the bushing is provided with projecting radial lugs 5, so that the bushing may be conveniently detached from the main when desired.

Above the lugs 5 the bushing is exteriorly screw threaded, as indicated at 6, to receive an interiorly-threaded depending flange or skirt 7, formed around the edge of the circular body 8, which is provided with a central aperture 9 to receive the neck or stem of the gas bag *X* to be employed for plugging the main.

To close the aperture 9 in the cap we employ a valve or cover 10, formed of a plate of metal or other suitable material of circular form, as shown in Fig. 3, said plate or valve being pivotally mounted at one side on a screw 11 at one side of the aperture or opening 9 in such a position that when the plate or valve is moved pivotally on said screw the aperture 9 will be closed, as indicated in Fig. 2. To permit of conveniently moving the valve or plate 10, said plate is provided with a projecting handle 12 at its side opposite the screw 11.

In using the device the bushing 2 is first secured in place, and the neck of the gas bag *X* having been inserted through the aperture or

Fig 1.

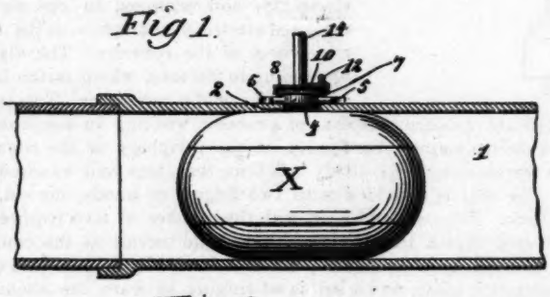
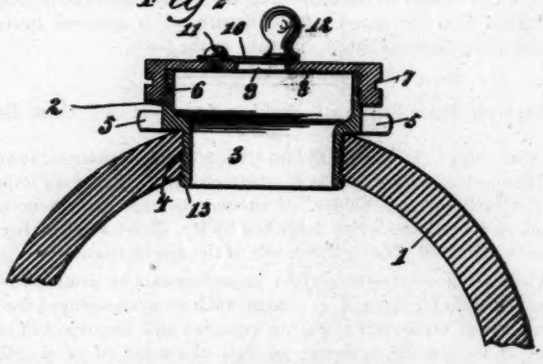


Fig 2.



opening 9 in the cap 8 said cap is screwed upon the bushing, the body portion of the gas bag depending through the bushing inside the main. The gas bag is thereupon inflated, as shown in Fig. 1, so as to effectually close the main to permit the same to be plugged in the ordinary way. When it is desired to remove the gas bag from the main, it is only necessary to remove the cap 8 from the bushing, so that the gas bag may be withdrawn, after which the neck of the gas bag *X* will be withdrawn from the aperture in the cap and the cap will be replaced, the aperture being then closed by means of the valve or plate 10, so as to prevent as much as possible the escape of gas from the main.

By preference the lower threaded portion of the bushing will be of such length as to project slightly beyond the inner wall of the main, as indicated in Fig. 2, so as to form an annular shoulder or bead surrounding the opening whereat the gas bag is inserted and withdrawn,

Fig 3

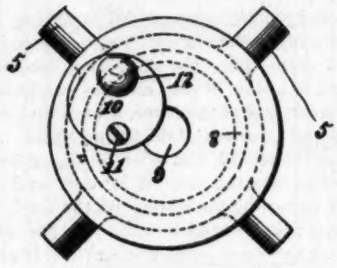


Fig 4

and the lower edge of the bushing will be by preference made rounded, as indicated at 13 in Fig. 2, so as to prevent wear of the gas bag by contact with said lower edge of the bushing.

From the above description it will be seen that the invention is of an extremely simple and inexpensive nature and permits of conveniently inserting and withdrawing the gas bag, at the same time preventing said bag from being torn or damaged by contact with the rough edges of the main; and it will also be obvious that the invention is susceptible of some modification without material departure from its principles or spirit, and for this reason we do not wish to be understood as limiting ourselves to the precise form and arrangement of the parts herein set forth.

The inside of the bushing is perfectly smooth, thus preventing the bag from being torn although in contact with the surface.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

A protective bushing and holder for gas bags comprising a tubular bushing having its lower portion provided with an exterior screw thread adapted to screw into an opening in a gas main or pipe, the said lower portion having a length slightly greatly than the thickness of the main or pipe, the lower end at the inner side being rounded, a cap adapted to screw on to the upper portion of the bushing and having an aperture through its top and a valve for closing said aperture, substantially as specified.

Magnetism for Engineers.[1]

When the physicists and mathematicians—to whom all honor is due—brought our knowledge of magnetic principles to its present state, the language in which they clothed the exposition of these principles was such that, in the way of a clear understanding of magnetic matters, it has ever been a stumbling block to the average electrical engineer. For this misfortune no one is, strictly speaking, to blame; the scientist and the engineer look at things from such totally different points of view that it is not to be wondered at if their methods of reasoning are dissimilar. But when the engineers, with the assistance of the Drs. Hopkinson and others, at length found a practical way of considering the question, by making use of the analogies existing between the magnetic circuit and other circuits of which they had had experience, they received, and quite naturally, no doubt, since even scientists are human, no support from headquarters; and moreover, when the electrical engineers—carried away by their superabundance of youthful enthusiasm—went too far, and discovered Ohm's law analogies in every apparent resemblance between sets of symbols, they were

1. *Electrical Review*, London.

greeted only with the silence of contempt, and allowed to lose themselves in their crooked ways. Text books, even to this day, continue to discuss the properties of *free* magnetism, and the behavior of imaginary emancipated unit poles, to the deep and everlasting confusion of the unfortunate student.

In the following pages we shall endeavor to elucidate some of those conceptions of the scientific mind which are a frequent cause of bewilderment to the electrical engineer who wishes to extend his knowledge of magnetic matters beyond what is usually considered sufficient for the purposes of dynamo design.

It is clearly understood that as the present article is written for the benefit of engineers who do not see things in the same light as the pure scientist, but only as in a glass, darkly, much of what might otherwise appear childish, and therefore of course superfluous, will stand a better chance of being judged at its true value.

Regarding our estimate of the intellectual powers of practical electricians and engineers, it must not be supposed—for perhaps we have not expressed ourselves quite clearly—that we consider these to be of an inferior order; on the contrary, an engineer, even though he may be fond of empirical formulæ, and may use various means to an end which are far from scientific, generally knows what the results of his calculations mean. If by some mischance this meaning is not clear to him, he is naturally at a disadvantage on account of his (probable) want of the necessary mathematical knowledge; but it is, nevertheless, a noticeable fact that he is inclined to be unhappy until he has cleared up the difficulty, and this he generally succeeds in accomplishing by some method of logical reasoning peculiar to himself.

Let us, in the first place, endeavor to throw a little light on the respective meanings of the symbols H and B. When a current is passed through a coil of wire, the coil becomes a source of magnetism; it may be looked upon as the force to which the magnetic condition of the surrounding medium is due. The strength and direction of the magnetic field at any point are fully defined when we are told what is the magnetic *induction* at the point considered.

A magnetic field may be conveniently represented (after Faraday) by *lines* or *tubes* of induction. Each unit tube of induction being replaced by a line passing down the center of it, it follows that the *intensity* or *strength* of the field is everywhere proportional to the closeness or density of these imaginary lines, while the resultant *direction* of the magnetic force at any point is that of the tangent to the magnetic lines at the point considered. The number of such unit magnetic lines per square centimeter of cross-section is, therefore, a measure of the magnitude of the magnetic induction. When the magnetic field is measured in a vacuum, or in air, or any known substance, with the exception of iron, nickel or cobalt, the induction is practically proportional to the magnetizing force, and it is denoted by H; but when it is measured in iron, it is no more proportional to the current in the coil, and it is now denoted by B

Consider a helix or solenoid consisting of a uniformly wound coil of wire of n turns per cm., this helix being bent round so as to form a closed coil having an air core of the shape known as an anchor ring. Let its mean periphery be l cms. Then if c is the number of amperes passing through the wire, the value of H at the interior of the coil is found (experimentally) to be given by the expression,

$$H = \frac{\frac{4\pi}{10} n c \times l}{l} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

The quantity $\frac{4\pi}{10} n c \times l$ has been called the magneto-motive force, as it is the force to which the *flux density* H is due. The analogy between such an arrangement and a tube filled with mercury through which a current of electricity is passing is so evident that it is not necessary to dwell upon it. We have merely to replace the *magneto*-motive force (M. M. F.) by the *electro*-motive force, and we obtain the expression:

$$\triangle = \frac{\text{E. M. F.}}{l},$$

where $\triangle$ stands for the current density in the mercury on the assumption that the specific resistance of the mercury is unity.

Returning to formula (1) we see that the flux of induction in a magnetic circuit which does not contain iron or any other "magnetic" material is governed by a law similar to that of Ohm for the electric circuit; the specific resistance of a vacuum or of air, or other "non-magnetic" substance being taken as unity.

We are now in a position to explain the meaning of an expression occasionally to be met with in text-books which is a frequent cause of bewilderment to the student or electrical engineer. We are told that, in air, "the magnetic force and magnetic induction have the same direction and mean the same thing."

Now, by again inspecting formula (1), it will be seen that H does not depend on the *length* of the magnetic circuit, but is simply proportional to the ampere turns per centimeter. Hence H is a measure of the magnetizing ampere turns *per centimeter*, which we have written $n c$. But both the expressions, "magneto-motive force" and "magnetizing ampere turns per cm.," are lengthy, and to a certain extent unscientific. Let us, therefore (for simplicity) divide what we have called the M. M. F. by l and call the result (for shortness) *the magnetic force*. H is then not only a measure of this magnetic force, but is numerically equal to it; we may, in fact, say with a *very* slight straining of the imagination that H *is* the magnetic force. Thus we see that, although we might have racked our brains in vain for any simile, however far-fetched, wherein the cause producing an effect and the effect itself are identical, this peculiarity of the magnetic circuit is as simple to understand as many another seeming mystery, once it has been properly explained. This is only one of the many instances of the danger and uselessness in always being on the look-out for some suitable analogy which may help us to get an understanding of what is new to us.

This conception of what has been called the magnetic force is, moreover, a very convenient one, because the magneto-motive force is the line integral of the magnetic force taken round a closed line; and further, the line integral of the magnetic force along a line 1 cm. long is simply the magnetic difference of potential per cm., which causes an induction of H lines per sq. cm. in air.

We have spoken of a *closed* magnetic line, and it will, perhaps, be unnecessary to remind the reader that every imaginary line or tube of induction must be considered as a closed line or loop. This at least is the usual way of stating the case; it is, however, not a strictly scientific conception. Instead of saying that the lines of induction are closed lines we should say that "the tubes of magnetic induction must be either in the form of closed solenoids re-entering into themselves after traversing a finite distance, or else in the form of endless solenoids which proceed to infinity."

This information regarding the behavior of what, in vulgar parlance, we call magnetic lines, ought not to discourage the student of the phenomena and principles of magnetism, for he has but to remember that those lines which leave one end of a magnet on their (apparently) endless journey do, as a matter of fact, always come in again at the other end; a state of things which, although it may lead to some interesting conclusions as to the nature and dimensions of infinity, does not seriously interfere with the more elementary ideas concerning the conservation of the flux of induction.

Having briefly considered the meaning of the symbol H, we will now attempt to clear up one or two obscure points on the subject of B. This symbol, as is well known, is generally used in England to denote the magnetic induction when this is measured in iron. It is the resultant flux of magnetism per square cm. due to all the magnetizing forces which are acting or have once acted upon the piece of iron in question. It varies considerably with the quality and condition of the iron, and it is only approximately proportional to the magnetizing forces between certain more or less variable limits. The Ohm's law simile, therefore, fails us here, and as a matter of fact, the conditions producing a given value of B in a given sample of iron must always be determined experimentally. If, in the closed solenoid already described, we imagine the air core to be replaced by an iron one, the induction is greater than it was before, and we may put

$$B = \mu H,$$

where H is the induction obtained with the air core, and μ is a multiplier which has been called the permeability.

This seems simple, but in reality it is not so. In the first place, μ is not a constant, but depends, among other things, upon the value of B itself; and in the second place, it is extremely unscientific to think of B otherwise than divided up into its constituent parts. These parts are $4\pi I$ and H; thus—

$$B = 4\pi I + H,$$

the meaning of which expression is clearly understood when we are told that I is the magnetic moment of the iron per cubic centimeter, and H is the magnetic force, or number of lines per square cm., which would be found in the place of the iron if the iron wasn't there.

A little consideration will make it evident that—since we have no reason for supposing that the number of lines *due to the coil* will disappear when the iron is introduced—the expression $4\pi I$ represents the number of lines *added* by the iron, and which we may assume owe their existence to the magnetic condition of the iron itself. I is there-

fore a measure of the physical condition of the iron; it is best defined as the intensity of magnetization of the iron, and it is a quantity of much scientific value. It is, however, of little interest to the engineer whose chief use of magnetism is to produce *inductive* effects. He is, therefore, more interested in the quantity B, which has been aptly called the *induction*, and he is inclined to entirely ignore, or even—with a sense of superiority born of ignorance—to ridicule the fundamental division of B into its constituent parts, a condition of things which, one can readily conceive, may be a trifle annoying to the scientists. The latter, however, most undoubtedly placed themselves in a disadvantageous position when one of their side referred to this division of B into $4\pi I$ and H as being "no doubt highly artificial." It is surely adding insult to injury to inform the struggling student, who has valiantly fought his way through a mass of more or less meaningless hieroglyphics, that the particular expression which strikes him as above all things senseless is "highly artificial." He supposes it is introduced for the amusement of the master mind, which thought irritates him, and it is not to be wondered at if he joins the ranks of those degenerate outcasts who see a resemblance to Ohm's law in the relation between all natural phenomena and their causes, and who use the term "magnetic resistance" without obtaining permission to do so from headquarters.

The multiplier, 4π, is undoubtedly a trifle exasperating; but our system of units makes it necessary, and if we consider the magnetic state of a bar of iron which we have called I, it is necessary, in order that we may denote by H the strength of the field surrounding the ends of the bar, that we should consider $4\pi I$ lines traversing the center portions of the bar.

Let us now consider the meaning of the expression $B = \pi I 4 + H$ when it is applied to permanent magnets.

If a ring of iron or steel is magnetized to what may be considered the saturation point, and the magnetizing force is then removed, the iron will retain a certain amount of *residual* magnetization which may be expressed as a percentage of the saturation value. The magnetic force which has to be applied in order to reduce this residual magnetization to zero has been called by Dr. Hopkinson the *coercive force*. If the sample experimented upon is not a ring, but a straight bar of no very great length as compared with its section, the residual magnetization—after it has been magnetized to the same (saturation) value as the ring—will now be less; but the coercive force will be the same provided the material of the sample is the same as before; in other words, the ampere turns per centimeter required to entirely demagnetize the sample are not dependent upon its shape. If, in the case of the ring sample, we had not only removed the magnetizing force but had applied a demagnetizing force equivalent to that required to overcome the resistance of the air path in the case of the bar magnet, the magnetization left in the ring would have been the same as that in the bar. Moreover, the fact that the same reversed ampere turns must be applied to demagnetize both the ring and the bar is only what we ought to expect when we remember that, although in the case of the straight bar, residual magnetization is less, the demagnetizing ampere turns have the resistance of the air path to overcome in addition to the hysterisis of iron.

These considerations suggest a method of treating the question of permanent magnets more likely to find favor with electrical engineers than the purely academic methods which involve the ideas of free magnetism and the demagnetizing forces exerted by the end elements of the steel. That the latter methods sometimes present difficulties to the non mathematical reader may be gathered from what follows.

We are told to consider a magnetized iron ring, the lines through which are $4\pi I$ per square cm. This ring is now supposed to be cut and straightened out. The lines of magnetization, we are told, are still $4\pi I$; but there will be lines of force running through the iron in the opposite direction, due to the free magnetism which adheres to the ends of the bar. We are therefore instructed to think of two groups of lines passing through the metal of a permanent bar magnet, one group being represented by $4\pi I$, the other by H, and these two groups of lines thread their way through the metal in opposite directions. Further calls are made on the imagination when we are told to picture in our minds an infinitesimally narrow gap, supposed to be cut through the body of the magnet. This is done for the purpose of giving us a clear idea of what is meant by B, for we are requested to count the total number of lines per square cm. crossing the gap, which number is said to be a measure of B; and it is evident that we are expected to make it $4\pi I - H$. We ourselves, not being gifted with a mathematical mind, have never been able to understand this; our total always comes out $4\pi I + H$.

When we think of an alternating current which is more or less out of phase with the E. M. F. producing it, we sometimes, for convenience, and for power calculations, divide up the current into two parts, the *work* component and the *wattless* component; but we do not *picture* to ourselves two distinct currents flowing in the circuit. For the same reason, *i.e.*, to prevent confusion, electrical engineers will find it safer to picture only the *resultant* magnetic field, as it is represented by *one* system of lines, the directness and closeness of which are a measure, at any point, of the direction and strength of the magnetic induction.

In a permanent steel magnet the physical condition of the metal is such as to tend to create a magnetic field in a certain direction, and in this respect it may be compared with a coil of wire through which an electric current is passing; other causes, such as the resistance of the magnetic circuit, and the magnetizing forces of neighboring electric currents, or permanent magnets, will determine the actual value of the induction in the body of the magnet itself.

With reference to the term "magnetic resistance" which we have unblushingly introduced in this article, we may say that we do not think it necessary to apologize for the use of it, seeing that we are writing for electrical engineers, who *all* use and understand it.

At first sight the expression appears harmless; but it has led to so many heated discussions, and so much bitterness and sarcasm and uncharitableness, that we may be excused for dwelling upon it at some length.

In the first place—and in order to save the useless expenditure of ink and paper—we will define what we understand by magnetic resistance as that attribute of the magnetic circuit, or portion of magnetic circuit, which stands in the way of the establishment of an infinite flux of induction. If the various portions of a magnetic circuit offered no resistance to the establishment and maintenance of the magnetic state, there would be no limit to the value of B.

Now, unless we were expressly informed of the fact, we should not ourselves conclude (1) that this resistance is constant under all conditions; and (2) that it involves a continuous expenditure of energy, even after the magnetic field is established and has reached a steady value. Yet the scientists tell us that these ideas are invariably associated in their minds with the term resistance, and do what they will they cannot get rid of them. Of course, under these circumstances, it would be unwise of them to use the expression, and if they consider themselves competent to deal with such a mouthful as "magnetic-reluctance-function," no one would be so foolish as to deny them the use of it. Our sole argument is that the engineers have as good a right to use the word "resistance" if it pleases them to do so.

The man who says that the total flux of induction through a magnetic circuit is the quotient of the magneto-motive force and the total magnetic resistance of the circuit, makes a statement which is true, and which does not, and never will, stand in the way of the proper understanding of magnetic matters; but if he deceives himself into believing that he has got hold of an expression which is the equivalent of Ohm's law for the electric circuit, we can only conclude that his intellectual faculties are not of such a high order as might be desirable. The whole essence of Ohm's law is the constancy of the electrical resistance whatever may be the strength of the current in the circuit; and this applies to all electric circuits, whatever may be the metal or metals of which they are composed. Such a miracle as this does not constantly repeat itself in nature; and when we find that iron, when subjected to increasing magnetizing forces, shows unmistakable signs of tending towards a condition of saturation, in other words, that its magnetic resistance increases more or less in proportion to the magnetizing force itself, we ought not to be surprised; nor should we say that on account of this abnormal behavior on the part of the magnetic circuit when the path of the induction happens to be through iron, we must on no account use so vulgar a word as resistance, but we must coin a new expression, such, for instance, as "magnetic-reluctance-function," which may be truly worthy of the phenomenon with which it is associated.

The scientists object that when we speak of the magnetic resistance of the iron we speak of something which has no physical meaning, as it is not an attribute of the metal itself; that is to say, it does not depend solely on the nature or physical condition of the iron. Without questioning the wisdom of this statement, we will confine ourselves to pointing out how the difficulty has been got over; it may suggest new lines of thought to the practical man. In order to avoid the use of such a conception as the magnetic resistance of a centimeter cube of iron, which has no physical meaning, we are instructed to think of its reciprocal, the magnetic conductivity (or permeability). This is a delightfully simple solution of the difficulty, as well as a useful one, especially as the reciprocal of the conductivity (or permeability) will, in its turn, give us the thing we want—but without naming it.

Cast Iron Steam Pipe.

The *Locomotive* remarks: It has been said that "things that are not constant are mighty uncertain," and the truth of this aphorism is nowhere better illustrated than in the use of cast iron steam pipe. We have in mind a large manufacturing establishment not a thousand miles from Connecticut, where a line of 8-inch cast iron pipe had been in use as a steam main for 14 years, carrying a pressure of 75 pounds. That part of the pipe which was in the boiler room had failed on several occasions, but each time there was some very fortunate circumstance about the accident, so that no great damage was done. It was feared, however, that this continued run of good fortune might not always prevail, and as a matter of precaution it was decided to take out the cast iron and put in something better. The pipe in the boiler room was removed and broken up for old iron, and was replaced by a modern wrought iron pipe with riveted flanges. The cast iron that had been in the boiler room was entirely discarded, as we have said, but those lengths that were in the engine room were supposed to be of superior quality, inasmuch as they were extra heavy, and were made "on honor," and so it was thought best to preserve this part of the piping for possible future use. Not long after the pipe had been changed the company wanted a cast iron column for some purpose or other, and bethinking themselves of the high grade piping that they had reluctantly taken out of the engine room, they put a section of it in the lathe to cut it off to the right length, and when they made the cut they made a discovery also. The nature of the discovery

Section of Cast Iron Steam Pipe.

is shown in the accompanying engraving, which is made to scale from a ring of the pipe that was sent to us for the purpose. On one side the pipe was 1¼ inches thick, and on the other its thickness was a scant quarter of an inch. It is hardly necessary to say that the firm that had used this pipe as a steam main for 14 years has had enough experience with cast iron steam pipe, even when it is "made on honor."

We do not question the good faith of the makers of the cast iron pipe that we have described. It is probable that they believed it to be sound and perfect, and we must therefore look to the process by which such pipe is made, if we wish to find the most likely explanation of the defect. In casting large pipe a hollow iron core is used, which is perforated with numerous holes and also studded on the outside with little points or projections. The core is coated to the proper thickness with a composition of flour, coarse sand and molasses, which is held in position by the projections or studs, and the whole is placed in an oven and baked. (Bolland recommends the following mixture for covering the core: "Eight parts of fine sand, two parts Jersey moulding sand, one part flour; mix with thick clay water.") When the covering is hard and dry the core is placed in the mould and the casting is made. The core being hollow and being immersed in the melted iron, will be buoyed up powerfully, and means must be provided to hold it in position. Yet even if the ends of the core are held firmly in position there is danger of the middle of it springing up by a sensible amount, unless it is quite stiff and rigid. A small amount of yielding will be sufficient to destroy the uniformity of thickness that is essential to good pipe. In the case described above the core must have been about 10 feet long, and a spring of half an inch at the middle (which is not at all impossible) would have been quite sufficient to account for the observed inequality in thickness.

The general conclusion to be drawn from this example, we suppose, is that cast iron should not be used for steam pipe. This is a corollary to the more general proposition that cast iron should not be used in any place where it will be exposed to a tensile stress. It is a good enough material for resisting compressive strains, but it is altogether too uncertain in its behavior to be trusted under tension.

Acetylene on Board Ships.

According to the *Gas World* "Acetylene Gas and Its Probable Future Afloat" was the title of a lecture that Professor Vivian B. Lewes delivered before the Institution of Naval Architects, on Thursday, April 8th. Having briefly described the discovery and properties of commercial calcic carbide and acetylene, Professor Lewes proceeded to discuss methods by which the latter might be applied on board ship. He said that the possibility of liquefying acetylene at pressures about those at which liquid carbon dioxide was produced so largely enabled considerable volumes of the gas to be compressed in the liquid state in small wrought iron or steel cylinders, and that it was in this liquefied condition that the gas would have to be utilized on board ship. At the freezing point, liquid acetylene would give about 370 times its own volume of gas. The pressure which liquid acetylene exerted upon the cylinders containing it varied with the temperature, but for all ordinary degrees of heat—say, from 60° to 75° F.—the pressure would be from 600 to 700 lbs. on the square inch, whilst when heated to 98° F. the pressure rose to 1,020 lbs The cylinders, however, were generally tested to two or three times this pressure, so that there was an ample margin of safety. During the past two years there had been two or three explosions caused by cylinders of liquefied acetylene, and these had given rise to a feeling that acetylene in this form was not safe; but it must be remembered that the introduction of a compound of this description, with comparatively unknown properties, must for a considerable period be hampered by accidents caused by improper usage; and there was proof that in each of the accidents that had occurred the screw plugs closing the cylinders were being tightened up with undue violence.

The Factor of Danger.—The factor of danger in liquid acetylene, and also in the compressed gas, was that acetylene was an endothermic compound—*i. e.*, a compound in the formation of which heat is absorbed, instead of, as is usually the case, being liberated—and with such compounds this heat was again set free when they underwent decomposition, and added considerably to the violence of the action. At any pressure up to 2 atmospheres acetylene was perfectly safe from any explosive action *per se*, as at these low pressures high temperature, or even the detonation of a charge of mercuric fulminate in the gas, only caused local decomposition, and the explosion did not travel for more than a few inches from the spot where it was started; but directly the gas was put under more than 2 atmospheres pressure a red heat would initiate explosion through the whole volume, this being due to the sudden resolution of the acetylene into its constituent elements, carbon and hydrogen, with the liberation of the endothermic heat stored up in it. This all sounded very alarming, but when the conditions of danger were realized it was at once evident that with rational treatment cylinders of liquid acetylene were for all practical purposes perfectly safe, as when kept in water tanks nothing short of the surroundings being on fire would give the requisite temperature to cause danger, and on board a vessel the cylinders could easily be dropped over board on a line until such danger had passed.

For Buoys and Lighthouses.—When it was considered that a cylinder holding 1 cubic foot of the liquefied gas would supply a burner giving a light of 32 candles for 400 hours, it was evident that there were great possibilities for it in the future on ships and yachts not fitted with the electric light. With a proper and special arrangement, highly efficient gas engines could be driven by it, and in small atmospheric burners it gave a flame of very high temperature; so that it was by no means impossible that the twentieth century might see a high speed torpedo boat driven by an acetylene engine, with an acetylene search light and an acetylene cooking stove, whilst some might even add to the equipment an acetylene torpedo, as a most effective "Sprengel" explosive might be made from liquid acetylene and chlorate of potash. These were dreams of the future, but there were certain spheres of utility ready for acetylene in which no plea of danger could be urged against its adoption. The first of these was floating buoys. At the present time there were four methods by which these could be lighted—(1) electricity, (2) compressed oil gas, (3) compressed coal gas enriched by gasoline, (4) Wigham's oil lamps. With electricity, the chance of the conducting wires being fouled by an anchor or dredge always existed; the compressed oil gas needed a small gas works and compressing plant; compressed coal gas and gasoline enrichment demanded the latter if not the former; whilst Mr. Wigham's oil lamps stood out as being both good and economical. There was room, however, for acetylene

for this purpose, and a cylinder of liquid acetylene having a capacity of 1.75 cubic feet, fitted with a reducing valve, and stored in the bottom of the buoy, would give a clear white light of 32 candles for one month, and in cost would even now be about equal to compressed oil gas giving the same amount of light. If legal restrictions should prevent liquid acetylene becoming a commercial commodity, then compressed acetylene gas in cylinders of the Pintsch or Pope pattern could be effectively used, the gas giving a candle power three times as high as the best freshly pumped oil gas. For such purposes as buoy lighting and for use in lightships, the cylinders of liquefied acetylene seemed to be especially adapted, whilst the still more important function of an auxiliary light for use in lighthouses would be best carried out with the uncompressed gas. For lighthouse use the apparatus would be so rapid in action that even with the holder empty gas could be made and the lantern burning within a very few minutes of the breakdown of the electric apparatus.

Penetrative Power.—Professor Lewes next spoke of the penetrative power of different lights, remarking that the usefulness of a light for signalling purposes depended upon its power of passing through the atmosphere without change or absorption. Measuring the penetrative powers of different lights by means of a cell containing an artificial haze, he obtained the following data, the figures being the percentage of light lost in passing through the cell:

Coal gas	11.1
Oil gas	11.5
Acetylene	14.7
Incandescent gas (Welsbach)	20.8
Electric arc	26.2

Of course, these figures merely gave the loss of light in passing through the thickness (3 inches) of fog solution employed; but it was evident that they would also give approximately the ratio of the penetrative power of these illuminants in mist-laden air.

Automatic Lights.—A minor, but, at the same time, very important, use to which calcic carbide could be put was in the manufacture of signal lights of the same character as the Holmes lights now in use. He had come across several specimens of carbide of Continental manufacture which gave acetylene spontaneously inflammable in air. On investigating this phenomenon he found that it was due to the carbide containing a certain proportion of calcic phosphide, which, on contact with water, gave enough spontaneously inflammable phosphureted hydrogen to ignite the acetylene. It naturally occurred to him that this might be utilized in making very valuable signal lights, of the same character as Holmes lights, for indicating the position of life belts, torpedoes, etc., as if the Holmes cartridge were filled with a mixture of calcic carbide and phosphide, only a small proportion of the phosphide served to make the acetylene, rapidly evolved on contact with water, ignite on coming in contact with air, and the light-giving power of the flame was far more effective than that emitted by the phosphide alone. Moreover, the cartridge could be made in the form of a hollow tube, so weighted as to float with its open end downwards; and if a small cage of the mixed carbide and phosphide were fixed in the upper portion, and a tube with a small burner let into the top of the cartridge, the gas escaping spontaneously lighted, and burned with a flat-flame of such intensity that it could be seen for a very great distance. He should imagine that if such a candle were attached to the life buoys flung overboard at night, it would not only guide a swimmer to the buoy, but also mark the direction in which the ship's boats had afterwards to proceed.

The Intimate Mixture of Gas and Air for Incandescent Gas Burners.

English Letters Patent, No. 1578, Jan. 22d, 1896, were issued to Mr. L. Denayrouze, of Neuilly, France, in which the claim of the inventor is, according to the London *Journal*, "For incandescent gas lighting, the method of effecting an intimate mixture of air and gas under the combined conditions, as to the composition, the pressure, and the velocity of the mixture, hereinbefore stated." A lengthy specification is provided, the main portions of which are reproduced—referring, as it does, to the inventor's previous patents, already described in these pages. The patents in question are No. 22,615 of 1894 and Nos. 4,494, 7722, and 14,053 of 1895.

The patentee says that, in these earlier specifications, he has described means which he was the first to employ in order to obtain "new industrial results in respect of incandescence gas lighting." By his preparation of a mixture of gas and air for incandescence mantles, burned on Bunsen or analogous burners, he claims to have realized a lighting power at least five times that obtained in the way in which these burners have been so far used. This mixture of air and gas is, he says, effected as follows:

"A very small power is applied, causing the molecules of air and gas to interpenetrate each other intimately, by means of a mixer the most simple type of which is a fan. The gaseous mixture thus formed at or near the burner, reaching the mantle under conditions most favorable for combustion, produces the maximum effect. On closely studying the phenomenon, after having practically realized it, I have been led to determine very exactly the manifold conditions which have to be satisfied by mixtures capable of producing such results. Once these conditions were known, I have been able to modify and extend, as I shall describe, the means which I at first employed for producing by such a mixture a light which is new, not only in respect of its splendor, but also in respect of certain special qualities which practice alone has revealed."

The mixture of air and gas should fulfil the following necessary and sufficient conditions: (1) It should have a certain chemical composition; (2) also a certain physical constitution; (3) and it should reach the mantle with a certain velocity. When these three conditions are all properly fulfilled, the complete luminous effect is produced. But if any one of the conditions is wanting, the effect is lessened—the combination determines the production of the phenomenon.

The patentee observed that the blades of the fan-mixer not only triturate and beat the air and gas, but that apparatus of this kind causes the mixture to issue at considerable speed, determined by the tangential velocity of the blades. With a particular mantle, the luminous effect goes on increasing up to a certain velocity, beyond which it decreases, while the pressure of the gas supply does not vary. Hence it is evident that, to consider the burner itself without taking into account at the same time the texture of the mantle and the character and pressure of the combustible supplied, and without also considering the velocity of the mixture as it reaches the particles to be rendered incandescent, is to look on only one part of the question, which "ought to be considered in its entirety, with all its amplitude and the variety of practical solutions of the problem."

When one considers the complete system in regard to the elements producing the light, it is seen that the quantity and quality of the light produced intimately depend on the manner in which the system permits approach to the following result: To give each solid particle of the mantle the maximum energy of vibration that can be realized without destruction or excessive fatigue of any part of the system. Thus stated, in all its generality, the problem admits of various solutions, which may be grouped in three series.

The first series consists of solutions in which the combustible (gas) is taken at the service pressure (20 to 30 mm.), and the air at atmospheric pressure, the mantle having the usual weight and volume of those employed with Bunsen burners. In this case it is only necessary to adjust within these limits the three conditions for establishing a good luminous system: Chemical composition of the mixture—1 of gas, 3 to 5 of air; physical constitution—pulverization of two fluids; and velocity of the mixture—1.5 to 2.5 meters per second. In this way there is obtained a mean light with 10 liters per Carcel. Hitherto efforts have been made to produce in the mixture a kind of stable molecular equilibrium; whereas experience shows that the effect desired can be produced only in a fluid in motion. No "new organs" are required, except that, in the system of pipes leading from the single mixer, openings are made proportioned to the volumes of the mantles; and the velocity of issue is rendered approximately the same at all the openings (which may be unequal or unequally distant from the flame) by partially throttling them with wire gauze, so as not only to regulate the velocity, but the time requisite to insure against explosion by the flame striking back.

The second series consists of solutions in which, while the mantle is that usually employed with Bunsen burners, the air and gas receive an initial pressure higher than that in the service pipes and the atmosphere. Good mixture can also be obtained in this way. It is only necessary and sufficient that the two fluids should lose, by means of baffles, the excess of velocity due to the initial pressure. Thus, if the blades of the fan mixers were stationary, so as to become simply baffles, and if the air and gas arriving separately under pressure had first to divide themselves in passing between these blades, and then the fan forced their laminæ against each other for intimate mixture through perforated plates or wire gauze, the result would be so much the better the more by these means approach were made to the three conditions of: Composition, 1 of gas to 3 or 4 of air; intimate trituration; velocity of issue, 6 to 12 meters.

The third series consists of solutions in which the incandescent bodies are no longer mantles of woven filaments, but are porous masses relatively thick. In this case the quantity of combustible gas and the velocity of the intimate mixture have both to be greater, the greater the mass of the body to be incandesced relatively to its volume. For apparatus of this kind, the gas alone (or both the gas and air) may be used under pressure. The speed of issue of the mixture should be greater the thicker the particles which it strikes as it issues. There is in this way no other limit to the production of the luminous effect than the resistance of the particles of the incandescent body to the mechanical force which tends to disperse them, or the heat which tends to fuse them. In this apparatus, violent incandescence effects can be produced by using "amadou" or sponges impregnated with usual liquids formed for salts of earths employed for making Welsbach mantles. Another good process consists in using naturally porous bodies sufficiently refractory—such as pumice stone or retort carbon, or bodies artificially made, having approximately the same molecular constitution. The form and texture of these porous bodies may be varied at will. Instead of very compact bodies, a sort of simple cartridge may be formed, containing filaments close together or entwined. Any kind of bundle, faggot, skein or tow of refractory wadding, forming a whole sufficiently strong, may (says the patentee) give good results, so long as the conditions of chemical composition, physical constitution and velocity of the issuing mixture are fulfilled.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

AT the annual meeting of the Plainfield (N. J.) Gas and Electric Light Company the following officers were chosen: Directors, H. G. Runkle, A. J. Bronson, William Runkle, F. A. Pope and E. G. Pope; President, A. J. Bronson; Secretary and Treasurer, H. G. Runkle.

MR. J. J. POWER, Superintendent of the Cumberland (Md.) Gas Light Company, writing to the JOURNAL under date of the 16th inst., says: "I inclose circular to show you that, although living in the heart of a great coal region, we are trying earnestly to popularize gas for fuel, especially in the instance of cooking. Our display will consist of various kinds of gas cooking stoves, heating stoves, water heaters, incandescent gas lamps, gas engines, etc."

A LOOK over the Cumberland Company's announcing circular shows that it invites the housekeepers of Cumberland to attend an exhibition of gas appliances for lighting, cooking, heating and power, the place of the display to be Belvidere Hall, Tuesday, Wednesday, Thursday and Friday of last week having been the dates selected. The Hall was to be open for the reception of visitors, from 1 to 11 P.M., and the guarantee was given that competent attendants would be present to explain the purpose and operation of the various devices shown. The main feature of the exhibition on the afternoons and evenings (at 3 P.M. and 8 P.M.) of the 21st and 22d was to be a demonstration lecture on cooking by gas, with Mrs. Gesine Lemcke, of the Brooklyn and New York College of Cooking, as the demonstrator. The Cumberland Company's practice in this respect could be profitably followed by many companies, the annual output of which is less than the Cumberland Company reports; and it may be taken for granted that the lectures given there last week will bear sound financial fruit.

IN our issue for March 1st (p. 330) we reported that the proprietors of the Consumers Gas Company, of Reading, Pa., had invited the housekeepers of that city to take part in a competition or contest, the basis of which was the forwarding to the Company, within a specified time, of a paper carrying ten reasons why gas should be used as a fuel in cooking stoves in preference to any other form of fuel. Two prizes were to be awarded, the first to consist of $10 in gold and a $20 gas cooker or heater; the second prize to be $5 in gold and a stove valued at $10. In response to this offer the Company received many replies, and in the end the prizes were awarded (first) to Miss Amanda G. Jones, 136 South 9th street, and (second) to Mrs. E. R. Gerber, 514 South 6th street. The contest or competition, which was brought off so successfully, was originated by Mr. Theodore Keppelman, who has charge of the Company's gas appliance department.

THE "10 reasons" that secured for Miss Jones the first prize are appended:

"1. If no one encouraged inventors, we would still be sewing with needle and thread. The gas stove is the invention of a genius; you want to encourage it.

"2. 'Cleanliness is next to godliness.' Are you clean with ashes in your hair, over your dress, and your hands roughened with it?

"3. As a matter of economy you need a gas stove; add the hauling of your ashes to the cost of your coal and see.

"4. You can procure a more even heat with a gas stove than is possible with coal.

"5. In case of sudden sickness, when your coal fire is fixed for the night, you can have boiling water in a few minutes with a gas stove. Your patient might die, while waiting for the kettle to boil, if you use coal.

"6. Have you forgotten how like a burning, fiery furnace your kitchen was last summer? With a gas stove you can cool your kitchen in a few minutes.

"7. You can save time in using a gas stove. You can lie in bed longer in the morning, and linger longer over the bargain counters in the afternoon.

"8. A gas stove is a muscle saver. Did you ever think how many tons of coal you use in the kitchen, and that you handle it twice, in carrying it up out of the cellar, and then again to the ash barrel.

"9. No one enjoys a coal oil stove, because of its offensive odor, nor a gasoline stove, because of the danger to life and property. A gas stove is both pleasant and safe.

"10. It is your duty, as a progressive citizen, in this last decade of this 19th century, not to be satisfied to do things as your great-grandmother did."

MR. J. H. ENRIGHT, formerly in charge of the works of the Meridian (Miss.) Gas Light Company, has been appointed Superintendent of the Nevada (Mo.) Light Company.

A SPECIAL meeting of the shareholders in the Louisville (Ky.) Gas Company was called for last Thursday, the purpose of the meeting, as set forth in the order by the Directors for the session, being to consider the affairs of the Company, and to determine upon a method for raising sufficient funds to provide for the necessary reconstruction and extension of a part of its plant, as proposed by the Board of Directors.

THE McKeesport (Pa.) *Herald* says that the United Coke and Chemical Company, of Glassport, Pa., has secured control of the franchises and business of the McKeesport Gas Company.

THE home offices of Messrs. Humphreys & Glasgow have been removed from 64 and 66 Broadway to the Bank of Commerce Building, No. 31 Nassau street.

A CORRESPONDENT at Decatur, Ills., forwards the following clipping: "The Decatur Gas Light and Coke Company is no more. It is out of business, and in future the property and business will be owned and conducted by the Decatur Light, Heat and Power Company, the capital stock of which is $250,000. The stockholders of the new Company held a meeting early this month and elected the following Directors: L. L. Burrows, J. J. Peddicord, Joseph Michl, Frank Schlaudeman, Charles G. Powers, W. C. Johns, J. K. Hamilton, B. K. Durfee and L. E. Eyman. It is the purpose of the new Company, which includes 25 or 30 stockholders, a number of whom reside at Toledo, O., and in Eastern cities, to make extensive improvements in the plant, by the purchase of new apparatus, in the extension of the gas mains, and in the stringing of more electric light and power lines. In the consolidation of the Companies, the stockholders bought the interest of the new Company which recently, through the efforts of Attorney Johns, secured a valuable gas franchise through the City Council by virtue of an ordinance. The gas franchise of the old Company has about run out, and in the new arrangement all rights and privileges are secured to those who in 1868 were instrumental in establishing the gas works, and to those who have since taken stock in the corporation."

THE Directors of the new Company of Decatur have named the following officers: President, B. K. Durfee; Vice-President, Frank Schlaudeman; Secretary and Treasurer, Lewis E. Eyman.

AT a meeting of the Morris county Board of Freeholders it was voted to permit the Morristown (N. J.) Gas Light Company to lay its mains through the adjacent settlements of Madison and Chatham, N. J.

THE proprietors of the Haverhill (Mass.) Gas Company have issued notice that on and after May 1st the selling rate will be put at $1.30 per 1,000 cubic feet, subject to a discount of 10 cents for prompt payment—within 10 days. This is a concession of 10 cents per 1,000.

THE Massachusetts Board of Gas and Electric Light Commissioners has assented to an issue of $190,000 thirty-year 5 per cent. bonds by the Boston Electric Light Company.

AT the annual meeting of the East Albany (N. Y.) Gas Light Company the following officers were elected: Directors, Frank Chamberlain, F. A. Sabbaton, Jas. H. Miller, H. A. Brooke and R. Merrifield; President, F. A. Sabbaton; Secretary, Frank Chamberlain; Treasurer, Jas. H. Miller; Superintendent, H. A. Brooke.

DURING the recent disastrous floods in the Western section of the United States, many gas plants were affected, even to the point of a temporary closing of the works. In the midst of the difficulties that beset them, the superintendents were quite up to the devising and carrying out of ingenious plans for keeping up the supply of light to their customers. As an instance of such ingenuity, the case of the Grand Forks (N. Dakota) Gas and Electric Light Company may be cited. The Red River of the North, which flows through Grand Forks, was well enough over its banks to interfere with the working of the gas and electric plant, especially in respect of power; but Manager Roycroft having made up his mind that steam must be had, secured a supply in the following novel manner. The tracks of the Great Northern Railroad are perhaps two squares distant from the gas works. On a convenient siding a locomotive was switched, and a pipe connection between its boiler and the engine of the gas works was maintained. This device tided the Company over the time until the Red River was no longer a disturbing factor.

AT the annual meeting of the Ann Arbor (Mich.) Gas Company the following result was reached: Directors, E. D. Kinne, Moses Seabolt, Wm. Wagner, S. T. Douglas and H. W. Douglas; President, E. D. Kinne; Secretary, H. W. Douglas; Treasurer and Superintendent, S. T. Douglas.

MR. A. W. FLETCHER has been appointed Manager of the Fort Madison (Iowa) gas works.

IT is reported that the properties and franchises of the Keystone Fuel Gas Company have been purchased by the proprietors of the Williamsport (Pa.) Gas Company.

AT the annual meeting of the Macon (Ga.) Gas Light and Water Company, the officers chosen were: President, A. E. Boardman; Vice-President, W. A. Jeter; Secretary, J. B. Hall. The plan for the reorganization of the Company has progressed to the point where it is safe to say that its complete rehabilitation will be accomplished before the end of June. The many friends of Mr. Arthur E. Boardman will greet this announcement heartily.

THE plant and franchises of the Athens (Ga.) Gas Light Company have been purchased by Mr. J. W. Cowdery of Atlanta, Ga., who will overhaul the system thoroughly.

MR. WILLIAM MCKENZIE, who owns a controlling interest in the Manitoba Gas and Electric Light Company, is negotiating with the authorities of Winnipeg for an extension of the Company's charter. He offers to extend the mains through sections not piped, and also agrees to make an important concession in the gas rate, for new franchise privileges.

THE proprietors of the Clinton (Iowa) Gas Light and Coke Company are again at work over business methods for the increased use of gas in that city, for cooking, heating and power purposes. This month they are running in one of the local papers a full page advertisement of the advantages of gas for cooking. The advertisement is profusely illustrated, the "pictures" being chiefly of the type humorous. In fact, any one who reads the *Merry War* (for such is the title of the Clinton newspaper received by us some days ago from a correspondent) cannot help noting the certainty that the Clinton Gas Light and Coke Company is doing business on a big scale. The selling rates at Clinton are as follows:

For fuel use	$1.25 per M, net.
For illuminating use	1.75 " "
For both fuel and illuminating purposes, in residences only, and where 1,000 cubic feet or over is used per month	1.25 " "

The Company runs gas services at a charge of 10 cents per foot; gas fitting in residences at 8 cents per foot; supplies, fixtures, chandeliers, etc., at wholesale cost to itself; and follows the same rule in respect of gas stoves.

THE Albany *Argus* says: "A highly interesting case was that of William P. Halpin against the Municipal Gas Company, of Albany, the decision in which was rendered in favor of the Company, by Justice George Addington of the City Court. In his opinion Judge Addington said: This is an action brought by plaintiff to recover $275 damages on account of the destruction of floors in the houses of plaintiff, on South Ferry street, and of the destruction of trees in front of said houses. The defendant had a right to lay its mains in the street, but it was incumbent on it to use its property so that it caused no damage to the property of adjoining owners. Part of the claim is outlawed, and there is absolutely no proper proof of damage on account of the destruction of the trees. (See Evans vs. Keystone Gas Company, 148 N. Y., 115.) It does not seem that the defendant is liable from the mere fact that gas leaked from its pipes and damaged property without some negligence or carelessness on the part of the defendant. (See also Loser vs. Buchanan et al., 51 N. Y., 476.) The subject of this action is very thoroughly and at length discussed in the above case and the cases distinguished. At page 484 the court says: 'We must have factories, machinery, dams, canals and railroads. They are demanded by the manifold wants of mankind, and lay as the basis of our civilization. If I have any of these upon my lands, and they are not a nuisance, and are not so managed as to become such, I am not responsible for every damage they accidentally and unavoidably do my neighbor.' In the Evans case, above cited, the court says: 'The two points for the jury to be convinced upon were was natural gas carelessly suffered to escape from the gas main, and was it the procuring cause of the destruction of the vitality in vegetation.' On the other hand it appears from plaintiff's own proof that there was a smell of gas in the houses for nine years, and that new floors were laid in 1888, 1892, 1894 and 1895. It also appears that the floors were curled up, and when they were taken up and a lighted match applied to the pieces of wood, there was a sudden flame which would immediately go out. Notwithstanding these facts no effort was made to remedy the evil, nor was the attention of the defendant called to the condition. From these facts, proved by plaintiff himself, even though he was not obliged to prove negligence on the part of defendant, it clearly appears that he stood idly by and saw his property destroyed year after year, without making an effort to remedy the defect when he was convinced that the damage was caused by gas. On this branch of the case alone it seems to me that he was guilty of an omission which precludes him from recovering any damages. Judgment for defendant."

THE following is from a recent issue of the Lincoln (Neb.) *Journal*: "H. C. Park has instituted a suit in the District Court for $20,000 damages done to his character and reputation by his arrest last September and subsequent incarceration on the charge of vagrancy. The defendants in the suit are President D. E. Thompson, Secretary J. K. Honeywell, Superintendent William Lawlor of the Gas Company, Mayor F. A. Graham, Judge Frank R. Waters, Chief of Police S. M. Melick, Clerk William B. Baird, Detective O. M. Routzahn and the Lincoln Gas Company. Park alleges that he was engaged in the inspection of gas meters last September. He says that Superintendent Lawlor, of the Gas Company, came to him and advised him to stop looking over their meters. He avers that he was told to give it up or he would be compelled to leave the city as another had before him. He said his living depended upon it and he could not forego his occupation. He claims that Mr. Lawlor and others then entered into a conspiracy to stop the inspection of the meters. Mr. Lawlor visited the City Clerk to find some ordinance Park was violating and, the plaintiff says, found none. Then he says Lawlor told him if he did not desist from the inspection he would have him arrested. He declined to stop. He says that, on September 5, 1896, W. B. Baird came to his place, where he was lying in bed ill, and ordered him to report at the station immediately. He says he went to the station with Mr. Baird and was searched, registered and thrown into a cell, without being permitted to see an attorney, although he requested that one be sent him. He avers that he lay in the jail from Saturday until Monday, being compelled to sleep upon the hard floor. He relates further that Monday morning he was arraigned before Judge Waters on a complaint made against him by Detective Routzahn, who charged him with vagrancy. He was sentenced to the county jail for 60 days and to pay the costs which amounted to a little over $5. He was sent to the county jail on a *mittimus* issued September 7, and he claims that up to that time he had not seen an attorney. He remained in jail until the 9th, when he was permitted to give bail as he had appealed the case to the District Court. On November 11, when the case came up for trial, the court discharged him. He thinks this worry and the ignominy of the arrest ought to be worth $20,000."

THE AMERICAN GAS LIGHT JOURNAL

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MONDAY, APRIL 26, 1897.

Electric Power from a New Mexico Coking Plant.

Messrs. H. Whigham and S. A. Schomburg, of the Raton Coal and Coke Company, are now installing at Blossburg, N. M., 3 miles from Raton, a new coking plant, embracing about seventy five 3 foot ovens in double banks. In the center will be erected a large battery of boilers, to which the waste gases of the coal will be conducted through central flues. The power thus generated will be converted into electricity to furnish power for the whole plant inside and outside of the mine. About 1½ miles from the coke ovens will be situated the Robinson washing and crushing plant, which is now in process of construction. It will have a capacity of 800 tons each 10 hours. The waste coal from the washing plant will be taken down a larry line by a small steam locomotive in 7-ton larry cars, each car carrying a charge for an oven and delivering it directly over and into the oven. All of the machinery, from tipple to mine opening, will be driven by electric motors, and in the main entry a trolley line is being built on which an electric locomotive of 150 horse power will bring the pit cars to the tipple. The latest improved mining machinery run by electricity will drive all of the entry work.

The Production of Electricity by Chemical Means.

For some time, says the London *Electrical Review*, E. Andreoli has been engaged in investigating the behavior of primary batteries, which depend, as regards their action, upon the continuous oxidation of hydrogen, carbon monoxide, etc. Although his results have been for the most part of a negative nature, they are none the less valuable on that account, inasmuch as it is often as useful to know that a thing cannot be done as that it can. During a portion of his investigation, he has been collaborating with Borchers, and together they have fixed upon the weak point in the batteries with which they have experimented. This consists in the use of electrodes, which become dissolved as the battery acts. They have both come to the conclusion that success with such batteries may only be secured by discovering and employing electrodes which do not pass into solution during the oxidation of the gas which is used in the battery; it remains, therefore, for themselves or others to discover and apply such electrodes. A full account is given of these later investigations in the *Zeitschrift für Electrochemie*, Vol. III., pages 186 to 189. It is of interest to note in this connection that Dr. Jaques, whose experiments have attracted attention, has gone to Europe to pursue some further researches.

The Market for Gas Securities.

After a queer exhibition of legislative ground and lofty tumbling, the Assembly, on the evening of last Tuesday, passed the bill, previously agreed to in the Senate, reducing the gas rate in New York city in the sum of 5 cents per 1,000 for each year until the figure of $1 per 1,000 is made. The bill is now in the Governor's hands, and there is no doubt that it will become a law. It is a fairly good measure, in that it *insures* the Companies from interference for a period of 5 years, by the end of which time, in fact, long before its end, the Companies will have effected considerable economies in their systems, through consolidation or otherwise. Important developments cannot fail to appear in city gas managements within the year. Under the influence of the passing of the act, city gas shares were strong during the week, Consolidated selling up to 164. This time it should go to at least 175. Mutual is nominally a shade lower, the reported asking figure being 250. East River common is also a trifle lower, while Equitable is in demand at 211 bid.

Brooklyn Union is 104¼ to 105, and the bonds are exceptionally strong, at 112 bid. Bay State advanced to 9¾ bid, Chicago is at the figures of a week ago, Baltimore Consolidated is dull and lower, at 58 to 59, and Consumers, of Jersey City, advanced to 80 bid. The Directors of the Consumers Company have declared a semi-annual dividend of 2 per cent., payable May 1. The books close to-morrow (Saturday), to be reopened May 3. A notable advance is reported in Wilmington (Del.) gas, which is again at the 200 mark. Lacledes are dull, while Western, of Milwaukee, is in good demand, at 65 bid. The Indiana group of gas stocks have attracted much attention of late, notably so in the instance of Indianapolis, a fair figure for which would likely be 134.

No one could make much of a mistake by having a "try" at any stock on the list just now, even at the figures asked by holders.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

APRIL 26.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	164	164¼
Central	500,000	50	195	..
" Scrip	230,000	..	100	.
Equitable	4,000,000	100	211	213
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	242	250
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	85	
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	55	56
Preferred	2,000,000	100	92	94
Bonds 1st 5's	3,500,000	1,000	107	108
" 1st Con. 5's	1,500,000	..	100	100¾
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	95	
Preferred	5,000,000	100	113	115
Bonds, 1st Mortgage, 5's	1,500,000	1,000	113	..
Yonkers	299,650	50	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	104¼	105
" " Bonds (5's)	15 000,000	1,000	112	113⅛
Bay State	15,000,000	50	9¾	10
" Income Bonds	2,000,000	1,000	..	35
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	..	85
2d " " "	3,000,000	1,000	70	72
Buffalo Mutual	750,000	100	125	..
" Bonds	300,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	81½	81¾
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	94	94¼
Columbus	1,069,000	..	72	74
1st Mortgage	1,085,000	..	..	96
Consumers, Jersey City	2,000,000	100	80	85
" Bonds	600,000	1,000	103	..
Cincinnati G. & C. Co.	8,500,000	100	201¾	202
Consumers, Toronto	1,000,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	1,000,000	100	58	59
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	.	22	..
" Con. Bonds	4,312,000	..	72½	74
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	80	83
" Bonds	2,000,000	..	89	92
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	132	135
" Bonds, 6's	2,650,000	..	103½	107½
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	84	88
Bonds	1,000,000	1,000	92	95
Louisville	2,270,000	50	..	..
Laclede, St. Louis	7,500,000	100	22	23
Preferred	2,500,000	100	74	77
Bonds	9,034,400	1,000	97	97½
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	98	98
Bonds, 6's	4,000,000	..	123	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	53¼	54
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10.000,000	100	97¾	98¼
St. Paul Gas Light Co.	1,500,000	100	79	81
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	500.000	25	..	..
Washington, D. C.	2,000,000	30	250	..
Western, Milwaukee	4,000,000	100	65	67
Bonds, 5's	3,556,000	.	94	95½
Wilmington, Del.	550,000	50	200	202

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GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md. 669
Continental Iron Works, Brooklyn, N. Y. 670
Deily & Fowler, Philadelphia, Pa. 672
Davis & Farnum Mfg. Co., Waltham, Mass. 668
Kerr Murray Mfg. Co., Fort Wayne, Ind. 668
Stacey Mfg. Co., Cincinnati, Ohio 671
R. D. Wood & Co., Philadelphia, Pa. 670
Logan Iron Works, Brooklyn, N. Y. 672
Riter & Conley, Pittsburgh, Pa. 655

GAS SECURITIES.

Gustavus Maas, New York City 653
Marquand & Parmly, New York City 653

BOOKS, ETC.

Scientific Books 673
Field's Analysis 664
Digest of Gas Cases 665
Directory of Gas Companies 673
Practical Photometry 666
Coal Tar Genealogical Tree 664
Management of Small Gas Works 658
Handbook on Gas Engines 654
Gas Flow Computers 654
Hughes' "Gas Works" 654

Stockholders' Meeting.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
DREXEL BUILDING, PHILA., April 21, 1897.

The Annual Meeting of the Stockholders of the United Gas Improvement Company will be held at the Company's Office, Drexel Building, Philadelphia, Monday, May 3d, at 12 o'clock noon, when an election will be held for a President and six (6) Directors to serve for the ensuing year, and such other business transacted as may be brought before the meeting.

The stock transfer books will be closed from 3 P.M., Tuesday, April 27th, until 10 A.M., Tuesday, May 4th.

1142-1 EDWARD C. LEE, Secretary.

Situation Desired

As Cashier, Asst. Supt. (or as Supt. of Small Gas or Water Works), or Bookkeeper for a Coal or Water Gas Plant. Has had seven years' experience as Sec. and Treas. of Water Gas and Electric Light Plant combined. Is familiar with reading both water and gas meters. Address

1139-4 "F.," care this Journal.

MANAGER.

A man wants a position to manage a gas property.

1139-5 "U. G. I.," care this Journal.

Position Desired

As Superintendent of Gas Works or Gas and Electric Light Works,

By a man 34 years of age. Sixteen years' experience in the manufacture and distribution of Coal Gas as Supt., and four years in the Electric line. Thoroughly competent to take charge of any plant, separately or combined. A practical mechanic, and understands the erection of gas plants and everything pertaining to the business. Not afraid of work. Salary no object until ability is proven. Best of references.

1102-tf Address "M. E. J.," care this Journal.

FOR SALE.

On account of changing location of our works and purchase of larger holder, we have for sale a Single-lift **Gasholder,** 80 x 20 feet, capacity 100,000 cubic feet. Complete and as good as new. Now in brick tank. Built by Stacey Mfg. Co in 1880. Holder has cup on bottom for telescoping, and guide framing is arranged and punched for additional section. Can be taken down and re-erected in brick or steel tank, as may be desired. Will be sold cheap.

THE AKRON GAS COMPANY,
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1119-tf Dubuque, Iowa.

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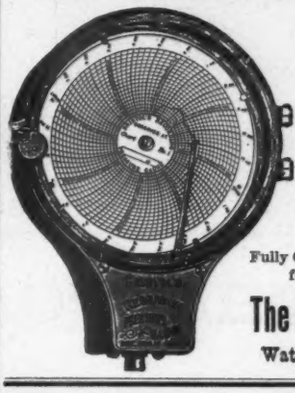

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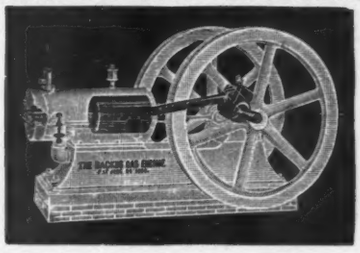

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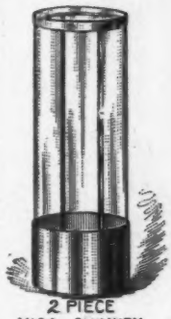

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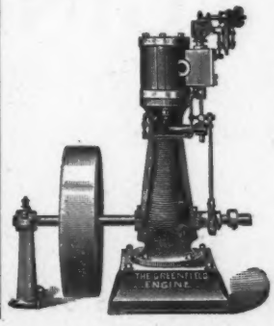

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Their Construction and Arrangement,

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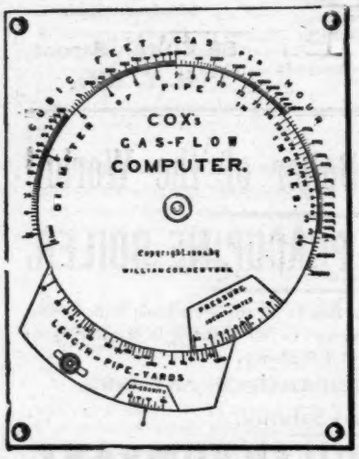

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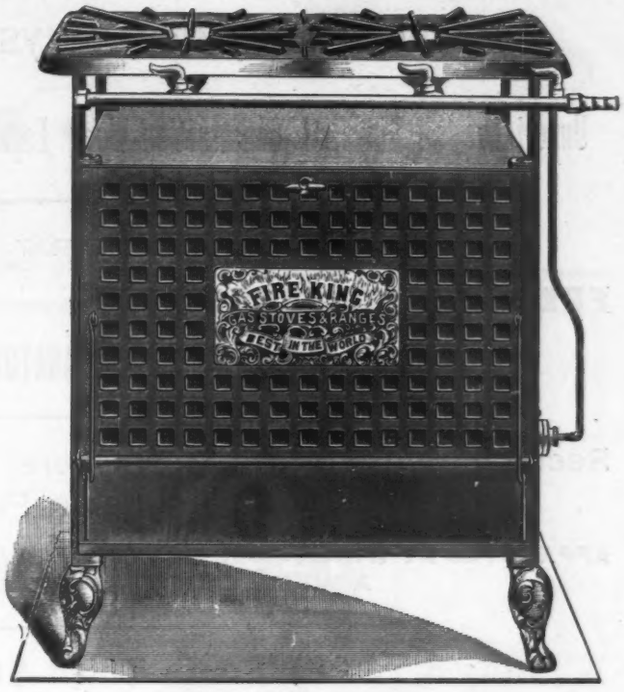

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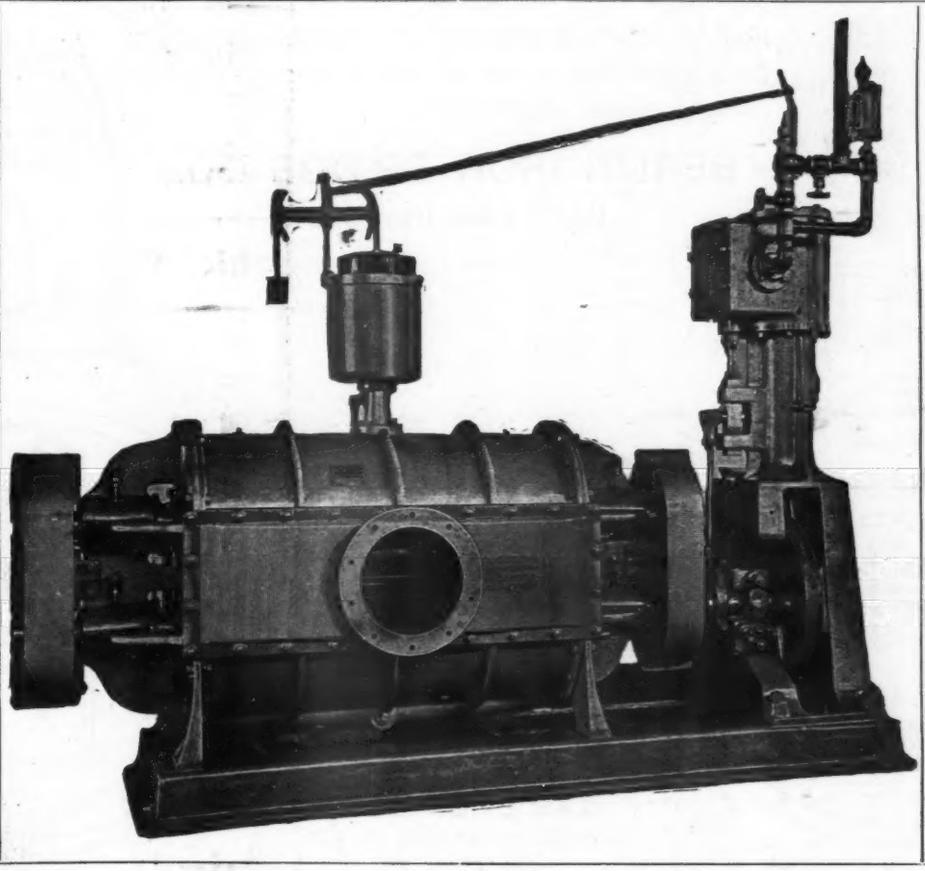

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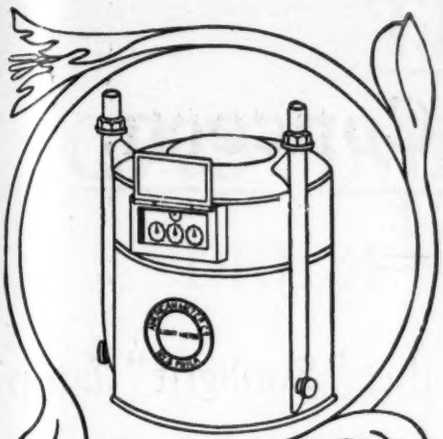

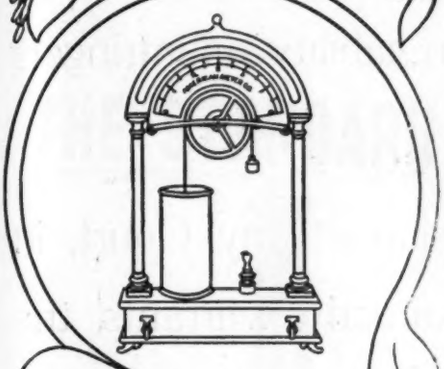

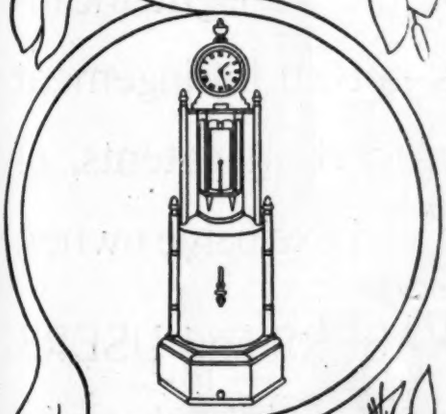

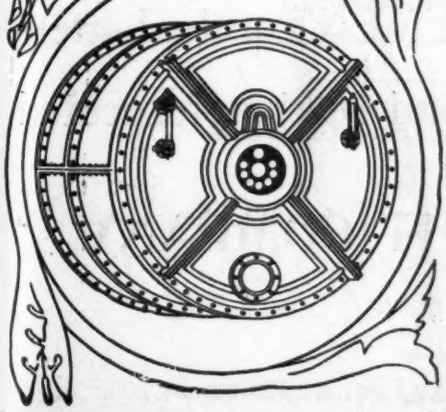

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SAN FRANCISCO.

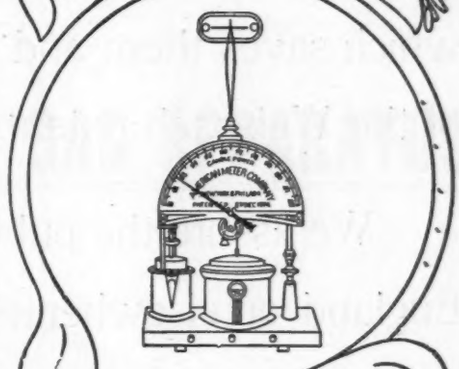
PUBLIC LIGHTING TABLE.

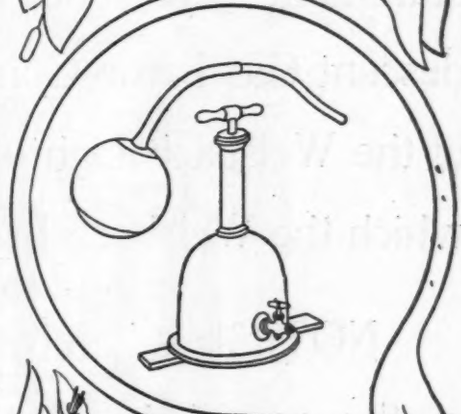
MAY, 1897.

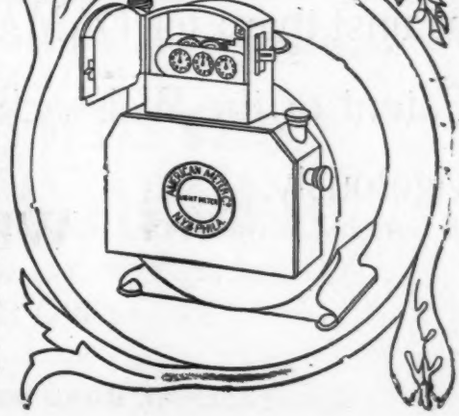
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Sat.	1	7.20 FM NM	4.00 AM	6.45	4.00
Sun.	2	7.30	4.00	6.45	4.00
Mon.	3	7.30	4.00	6.45	4.00
Tue.	4	7.30	4.00	6.45	4.00
Wed.	5	7.30	4.00	6.45	4.00
Thu.	6	10.40	4.00	6.45	4.00
Fri.	7	11.10	4.00	6.55	3.40
Sat.	8	11.50	4.00	6.55	3.40
Sun.	9	12.10 AM FQ	3.50	6.55	3.40
Mon.	10	12.40	3.50	6.55	3.40
Tue.	11	1.10	3.50	6.55	3.40
Wed	12	1.30	3.50	6.55	3.40
Thu.	13	2.00	3.50	6.55	3.40
Fri.	14	No L.	No L.	7.00	3.30
Sat.	15	No L. FM	No L.	7.00	3.30
Sun.	16	No L.	No L.	7.00	3.30
Mon.	17	7.40 PM	10.10 PM	7.00	3.30
Tue.	18	7.40	11.10	7.00	3.30
Wed.	19	7.40	12.00 AM	7.00	3.30
Thu.	20	7.40	12.40	7.00	3.30
Fri.	21	7.40	1.10	7.10	3.15
Sat.	22	7.40 LQ	1.40	7.10	3.15
Sun.	23	7.50	2.00	7.10	3.15
Mon.	24	7.50	2.20	7.10	3.15
Tue.	25	7.50	2.40	7.10	3.15
Wed.	26	7.50	3.00	7.10	3.15
Thu.	27	7.50	3.40	7.10	3.15
Fri.	28	7.50	3.40	7.15	3.15
Sat.	29	7.50	3.40	7.15	3.15
Sun.	30	7.50 NM	3.30	7.15	3.15
Mon.	31	7.50	3.30	7.15	3 15

TOTAL HOURS LIGHTING DURING 1897.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	233.00	January	423.20
February	187.20	February	355.25
March	202.00	March	355.35
April	170.40	April	298.50
May	163.00	May	264.50
June	140.40	June	234.25
July	151.40	July	243.45
August	167.30	August	280.25
September	174.40	September	321.15
October	200.00	October	374.30
November	205.20	November	401.40
December	220.10	December	433.45
Total, yr.	2216.00	Total, yr.	3987.45







To Whom It May Concern.

WE have learned that the makers of the "Sunlight" lamp assert that there has been a decision in the English Courts which saves them and their customers from liability as infringers of the Welsbach patents.

We assure the public there is no decision of any Court, in England or elsewhere, that directly or indirectly warrants the statement or inference that the lamp sold by the Sunlight Incandescent Gas Lamp Company of America is not an infringement of the Welsbach Light as made under the American patents, of which the Welsbach Light Company is sole and exclusive owner.

NOTICE is hereby given to all PURCHASERS and USERS of the so-called "Sunlight" lamp that suits will be brought against them for DAMAGES for INFRINGEMENT of the Letters Patent of the Welsbach Light Company, and will be prosecuted vigorously.

WELSBACH LIGHT COMPANY.

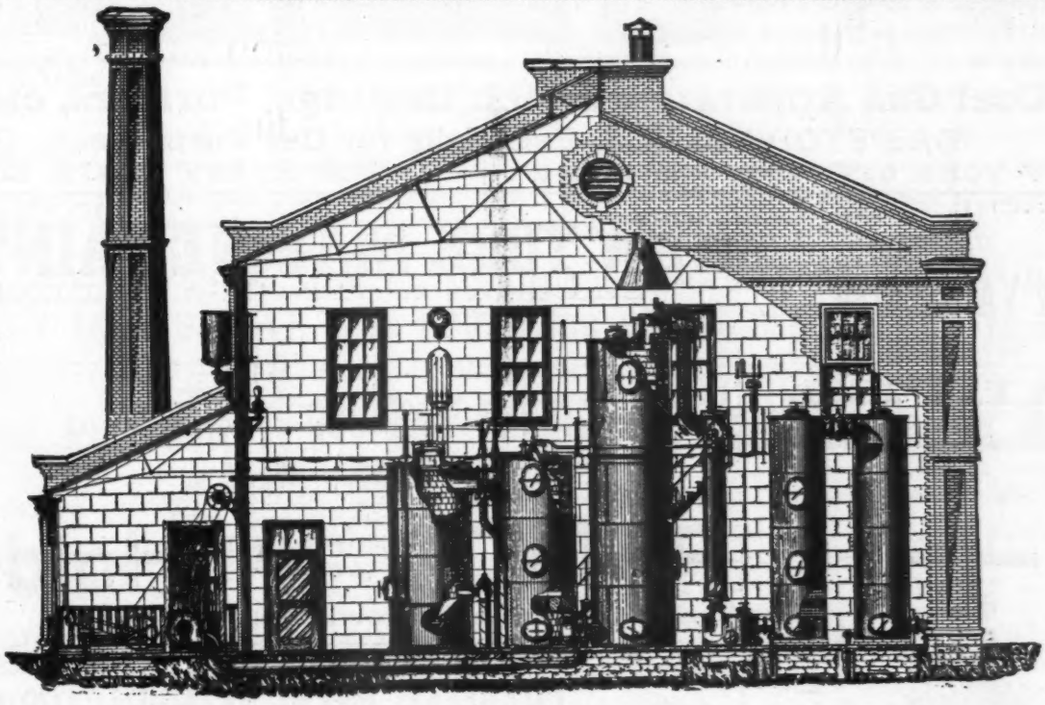
THE UNITED GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Inquiries from any part of the United States should be addressed to the Philadelphia Office.

BUILDERS OF

THE STANDARD LOWE WATER GAS APPARATUS.



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Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

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Fort Wayne, Ind.

ENGINEERS AND BUILDERS OF GAS WORKS.

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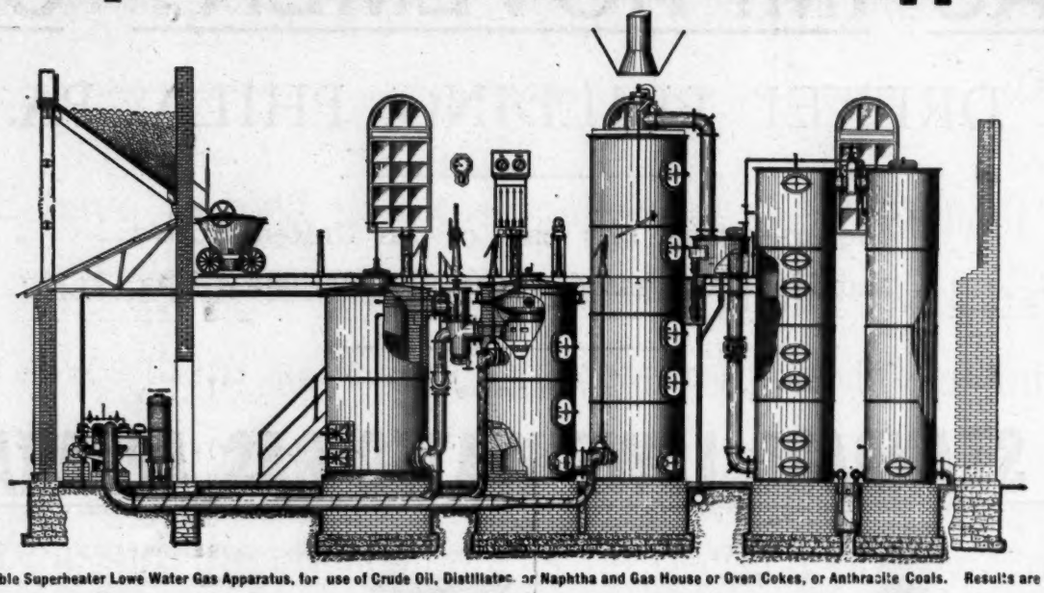

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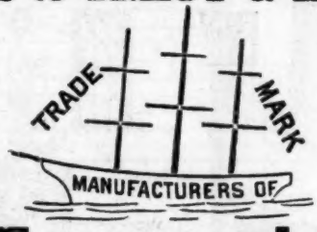

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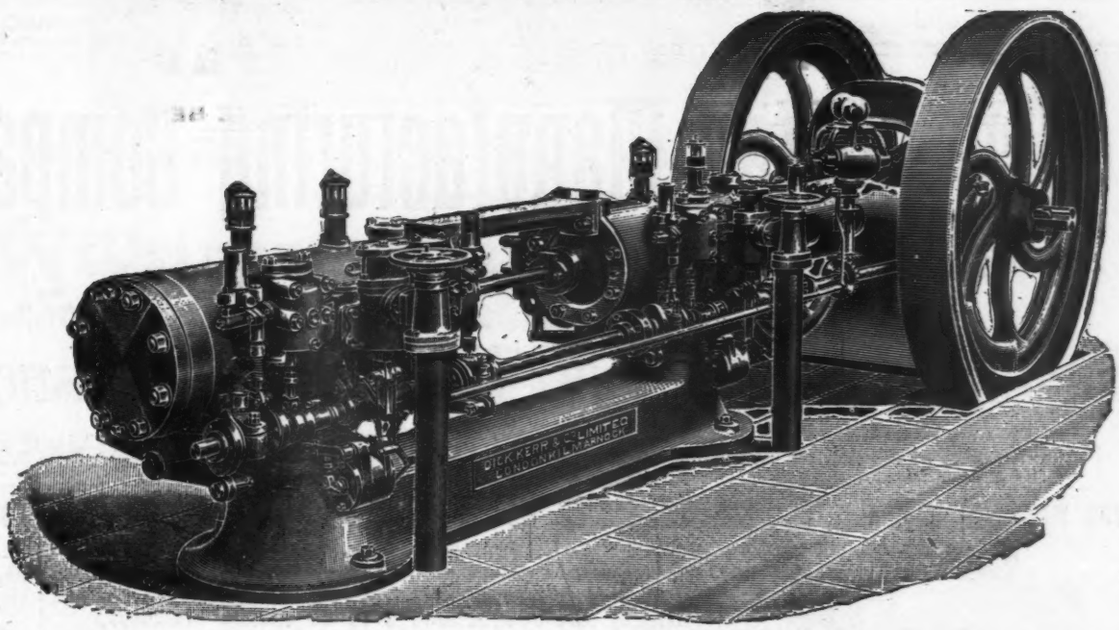

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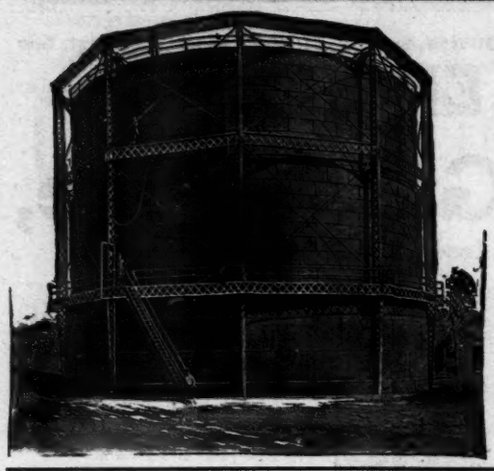

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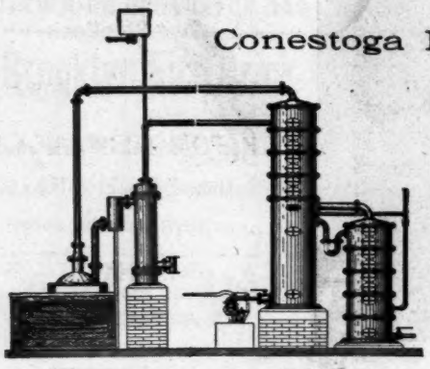

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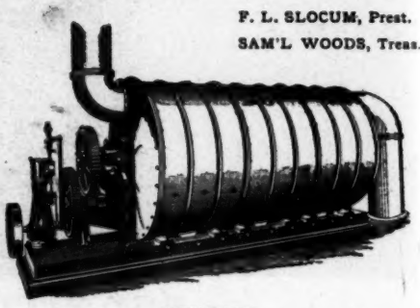

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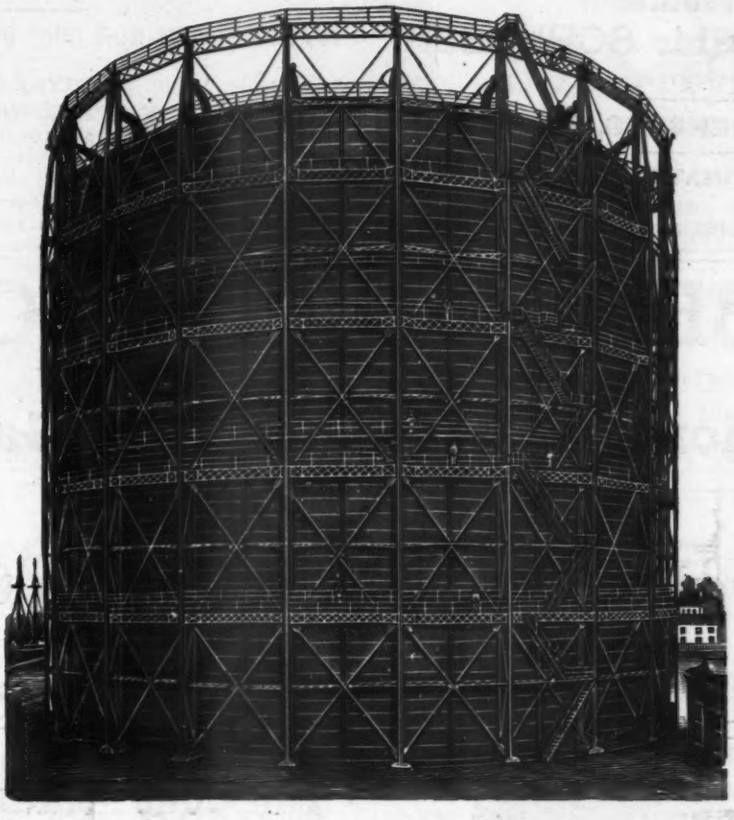

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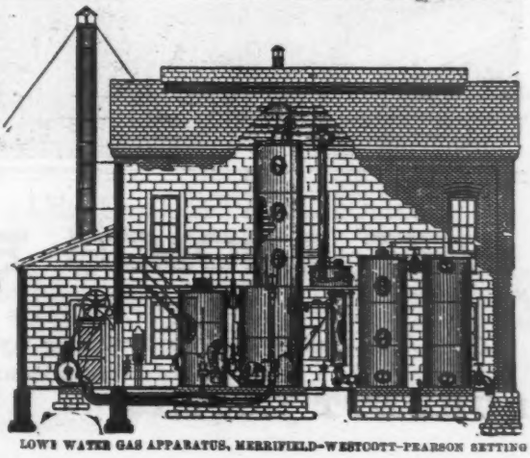

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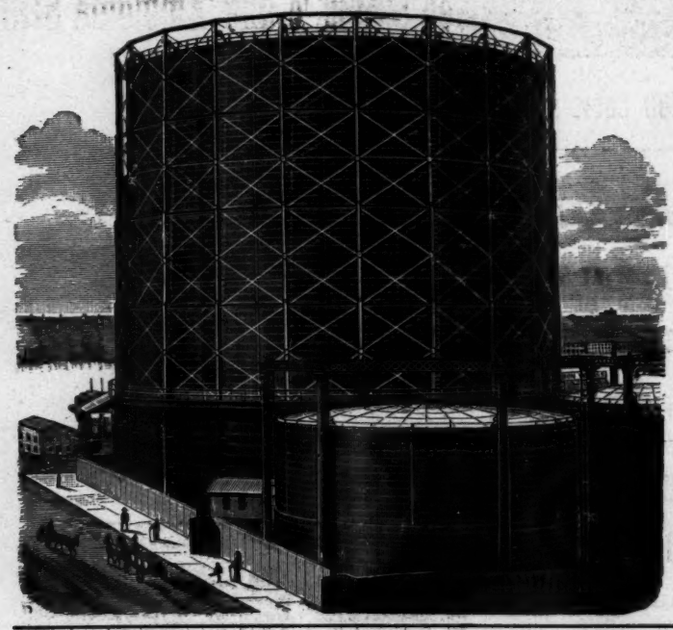

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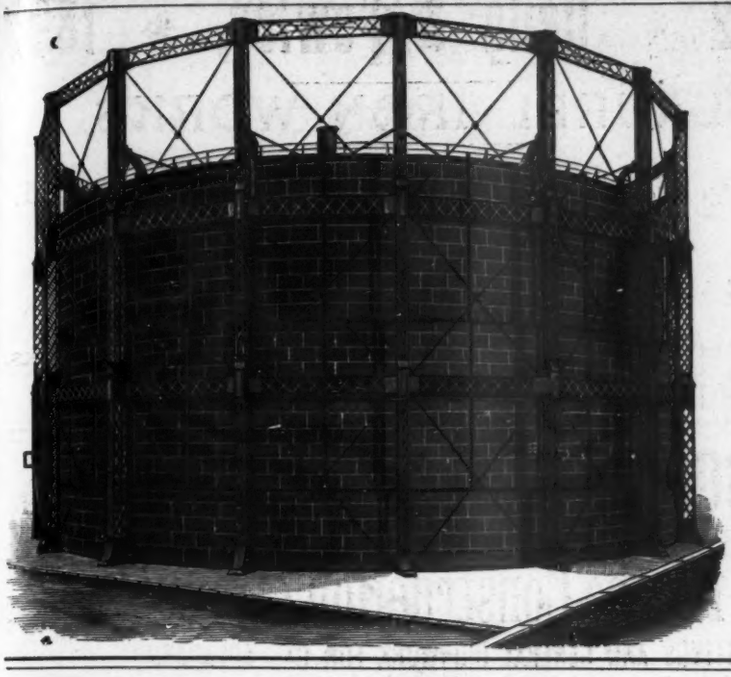

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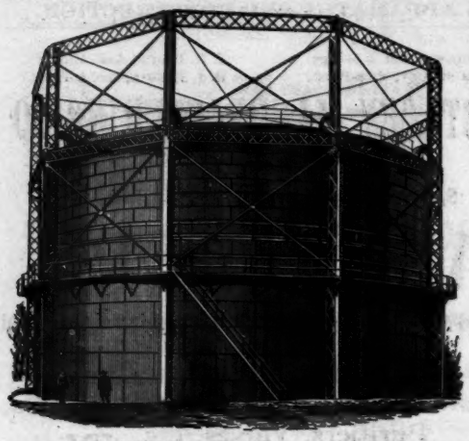

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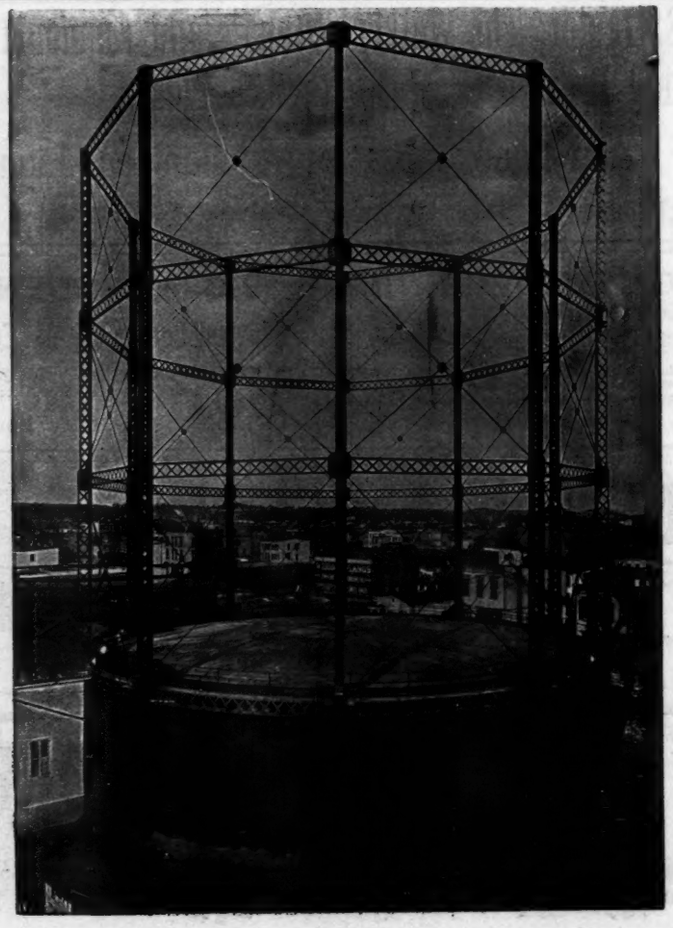

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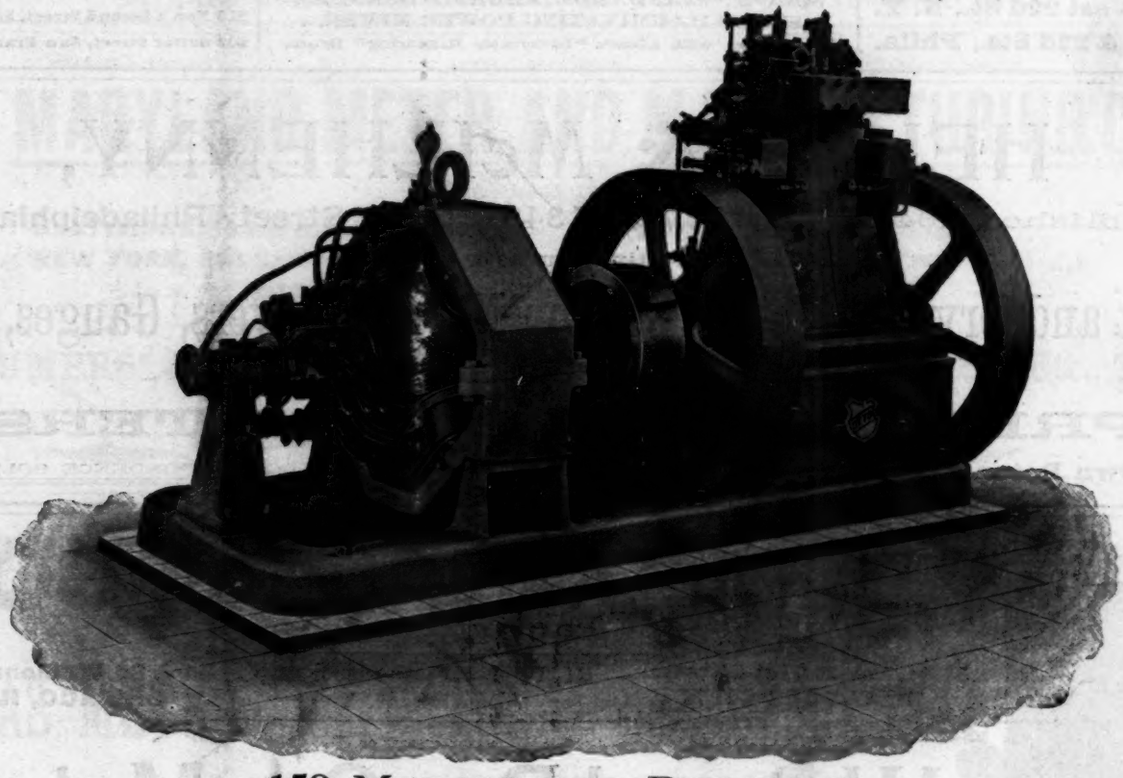

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